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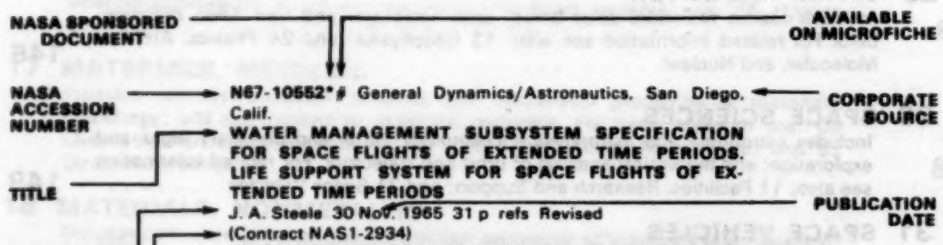
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N67-10552*# General Dynamics/Astronautics, San Diego, Calif.
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TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
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(Contract NAS1-2934)
REPORT NUMBER
(NASA-CR-67600; GD/A-64-26211, Rev. A)
CFSTI: HC $2.00/MF $0.50
CSCL 06K
SALES AGENCY AND PRICE
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed.
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VOLUME 5 NUMBER 1

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

January 8, 1967

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N67-10037# National Aerospace Lab., Tokyo (Japan).
ON REVERSAL OF EFFECTIVENESS OF CONTROL SURFACES IN TRANSONIC FLOW
Nobuhiko Kamiya and Shinsaku Segawa May 1966 47 p refs In JAPANESE; ENGLISH summary
(NAL-TR-106) CFSTI: HC $2.00/MF $0.50

A series of experiments has been carried out in order to investigate the control surface effectiveness in transonic flow. Number of models tested were nine in total. Four of them were small two-dimensional wings; the chord length of which was about 50 mm and the test Reynolds numbers of the models ranged from 6.3×10^5 to 8.3×10^5. Three of the models were large two-dimensional wings; the chord length of which was about 400 mm and the test Reynolds numbers ranged from 3×10^6 to 4.5×10^6. The other two models were 35° swept-back wings; the mean aerodynamic chord of which was about 400 mm and the test Reynolds members ranged from 4.1×10^6 to 4.4×10^6. The reversal of control surface effectiveness occurred in all cases. The aerodynamic mechanism of the reversal was clarified: it appears that the reversal of the control surface effectiveness of two dimensional or swept back wings will probably occur, whatever the wing sections may be and no matter what the test Reynolds numbers may be, provided the wing sections are not blunt at the trailing edges and that the boundary layer on the control surface is turbulent. Author

N67-10044# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AIRFOIL OF FINITE SPAN IN PRESENCE OF MOVING SHOCK WAVE
E. A. Krasil'shchikova *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 35–48 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

The motion of a thin weakly bent airfoil is considered with a small angle of attack and a weak shock wave falling on it. It is assumed that the main motion of the airfoil is forward and rectilinear at constant supersonic velocity in an infinite volume of compressible medium, and that the main motion of the airfoil superimposes small additional unsteady motion when the airfoil surface is strained. The boundary value problem is solved, and a mobile system in which the coordinate axes move in space with the airfoil is described. The problem is considered when the shock wave moves in the opposite direction to airfoil motion, when the shock wave moves in the same direction, and when the airfoil overtakes the wave. N.E.N.

N67-10048# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF TRANSIENT AERODYNAMIC CHARACTERISTICS OF CONES
S. M. Belotserkovskii, B. K. Skripach, and V. G. Tabachnikov *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 79–82 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

Forces and moments for slender cones at low subsonic velocities were investigated. Test data were compared with calculations by the linear theory for corresponding delta airfoils. It was concluded that the calculated and test values for slender cones is satisfactory when the flow around the cone is continuous, i.e. at low angles of attack. The case for large angles of attack is mentioned. N.E.N.

N67-10049# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLOTTING SUPERSONIC FLOW AROUND SOLID BODIES BY MEANS OF PLANE SHOCK WAVES
G. I. Maikapar *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 83–88 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

Supersonic flow around cones with star-shaped cross sections is described, and it is shown that it is possible to use a system of four intersecting plane shock waves for plotting the flow. Bodies with regular polygon cross sections, with small increase of cross section along the length, with fins, and with wings are considered. It was found that there is a significant difference between cases of flow when only the velocity component is after the subsonic shock wave and when the entire velocity is after the subsonic shock wave. N.E.N.

N67-10050# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESISTANCE OF AN OBLIQUE LEADING AIR FOIL EDGE AT HYPERSONIC VELOCITIES
V. V. Keldysh *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 89–94 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

Experimental data and calculations of resistance of blunt leading airfoil edge are reviewed. Results indicate that at low angles of attack, the blunt edge of the delta airfoil has approximately the same flow around it as a slip airfoil. The determination of wave resistance of a blunt leading edge of a slip airfoil is outlined. The relation of the angle of attack and the wave resistance is discussed. It was concluded that for oblique and delta airfoils, increase of the angle of attack may lead to significant increase of wave resistance of the blunt edge when the sweep angle is greater than 30°. N.E.N.

N67-10205*# National Aeronautics and Space Administration, Washington, D. C.

DAMPING OF VIBRATIONS OF THE BLADING OF AN OPERATING TURBINE SUR L'AMORTISSEMENT DES VIBRATIONS D'UN AUBAGE DE TURBOMACHINE EN FONCTIONNEMENT]

J. L. Deschamps Sep. 1966 101 p refs Transl. into ENGLISH of Publ. Sci. et Tech. du Min. de l'Air no. 421, 1965
(NASA-TT-F-10248) CFSTI: HC $3.00/MF $0.75 CSCL 01A

An attempt to provide a rational explanation of some results obtained from wind-tunnel experiments on turbine blading. A distribution of aerodynamic singularities, characteristic of the stability of a viscous flow, supplies the aerodynamic forces in a system of blading, starting from the velocity diagram. The method of concentrated masses makes it possible to express the mechanical forces developed during vibration. The transient aerodynamic regime features a cyclical deformation of the velocity diagram, which modifies the expression for the circulation in the steady-state regime. With the alternate detachments and reattachments at the profile points, a supplementary term appears which can, in agreement with certain experimental results, change the sign of the damping coefficient. Author

N67-10234*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

AERODYNAMIC CHARACTERISTICS OF 0.187-SCALE MODEL OF A TARGET MISSILE AT MACH 1.80 TO 2.16

William A. Corlett Washington, NASA, Nov. 1966 80 p
(NASA-TM-X-1304) CFSTI: HC $2.50/MF $0.75 CSCL 01A

An investigation has been made in a wind tunnel at Mach numbers 1.80, 2.00, and 2.16 to determine the aerodynamic characteristics of a 0.187-scale model of a target missile. The model consisted of a fuselage (of fineness ratio 22.9) with conventional wings and tail-fin controls, above which was a large nacelle, pylon-mounted. The tests were conducted through an angle-of-attack range of approximately $-4°$ to $12°$ and an angle-of-sideslip range from approximately $-6°$ to $6°$ at a constant Reynolds number of 10.55×10^6 based on fuselage length. The results indicated satisfactory longitudinal and directional stability characteristics at low angles of attack throughout the test Mach number range; however, some pitch-up and yaw nonlinearity was indicated at the higher angles of attack. A reduction in nacelle mass-flow ratio resulted in a sizable increase in drag coefficient and zero-lift pitching-moment coefficient. The pitch control effectiveness of the tail fins increased slightly with increase in angle of attack. Differential deflection of the tail fins provided roll control with sizable amounts of yaw and corrective deflections of the rudder added to the roll power. Author

N67-10254*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

HIGH-AMPLITUDE DYNAMIC-STABILITY CHARACTERISTICS OF BLUNT 10-DEGREE CONES

Robert H. Prislin 15 Oct. 1966 21 p refs
(Contract NAS7-100)
(NASA-CR-79320; JPL-TR-32-1021) CFSTI: HC $1.00/MF $0.50 CSCL 01A

Dynamic-stability characteristics of spherically blunted 10° cones were investigated in supersonic and hypersonic wind-tunnels by free-flight and captive free-oscillation techniques. Parameters considered include center-of-rotation, oscillation-amplitude, Mach number, and Reynolds number. For the very blunt shapes, dynamic stability was insensitive to changes in both oscillation amplitude and Mach numbe, but for a sharp cone, large changes were evident. As the Mach number increased from low to high supersonic, dynamic stability decreased. As the Mach number continued to increase into the hypersonic regime, the sharp cone became more stable. Variations in Reynolds number have a significant effect on dynamic stability coefficients. The magnitude of this effect decreases with increasing model nose bluntness, oscillation amplitude, and Mach number. At the higher Mach numbers, correlation between results obtained with the alternate testing techniques is excellent. But, at the lower Mach numbers ($M=2$) the agreement is less satisfactory, mainly because of scatter and poor quality of the captive data. Author

N67-10346# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE AERODYNAMIC PROPERTIES OF AIRFOILS NEAR STALL IN A TWO-DIMENSIONAL NONUNIFORMLY SHEARED FLOW

W. G. Brady and G. R. Ludwig Jun. 1966 118 p refs
(Contract DA-44-177-AMC-268(T))
(CAL-AF-2035-S-1; USAAVLABS-TR-66-35; AD-638361) CFSTI: HC $4.00/MF $0.75

A theoretical method, which requires the use of a digital computer, was developed to predict pressure distributions on an airfoil in an inviscid two-dimensional nonuniformly sheared flow. The theory is applicable to airfoils of arbitrary profile and to nonuniformly sheared flows which can be represented by segments with linear velocity profiles. To test the developed theory, aerodynamic characteristics of an airfoil were investigated both theoretically and experimentally in a relatively simple two-dimensional nonuniformly sheared flow consisting of two segments with shears of equal magnitude but of opposite sign. Agreement between computed and experimental pressure distributions was good and on the basis of these results, a mechanism is postulated by which the large variations in lift previously observed in a two-dimensional nonuniformly sheared flow can occur Author (TAB)

N67-10443# Library of Congress, Washington, D. C. Aerospace Technology Div.

NUCLEAR WEAPON DYNAMICS Surveys of Foreign Scientific and Technical Literature, 1963–1966

Simon Kassel 13 Jun. 1966 80 p refs Compilation of Abstracts
(ATD-66-70)

Abstracts based on Soviet open sources published 1963–1966 are presented. The report is divided into the following sections: (1) aerodynamic flow fields at hypersonic velocities, (2) nonequilibrium processes, (3) boundary layer at hypersonic velocities, (4) high velocity impact, (5) plasma–vehicle interaction, (6) gas–solid surface interaction, and (7) thermal effects. Author

N67-10457# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

THEORETICAL PREDICTION OF THE FLOW IN THE WAKE OF A HELICOPTER ROTOR. ADDENDUM: EFFECTS DUE TO A FUSELAGE IN A CONSTANT, NONUNIFORM FLOW Final Report, Jan.–May 1966

Peter Crimi and Andrew R. Trenka Aug. 1966 53 p refs
(Contract DA-30-069-AMC-645(R))
(CAL-BB-1994-S-3; AD-637872)

The addendum reports the results of an extension to the study to determine the time varying flow in the vicinity of a helicopter rotor in hovering and forward flight and having a fuselage immersed in the rotor wake. The purpose of the extension was to compare two models representing the fuselage. The first fuselage model (AD-629 782 and AD-629 783), was based upon the assumption that the fuselage was immersed in a constant and uniform flow; the second model was based upon the assumption that the fuselage was immersed in a constant but nonuniform flow. Comparisons between the two models are presented. Program listings and operational information related to the programs are given Author (TAB)

N67-10475# College of Aeronautics, Cranfield (England).

FURTHER TESTS OF A LAMINAR FLOW SWEPT WING WITH BOUNDARY LAYER CONTROL BY SUCTION

R. R. Landeryou (Handley Page, Ltd.) and P. G. Porter May 1966 66 p refs
(Contract KD/18/09/CB63(a))
(COA-AERO-192) CFSTI: HC $3.00/MF $0.75

Laminar flow was obtained, at the instrumentation position (90% chord) up to a unit Reynolds number of 1.87×10^6 per foot. It was also demonstrated that it was possible to achieve 99% laminarisation of the laminarisable area forward of 90% chord at a unit Reynolds number of 1.58×10^6 per foot. Complete suppression of leading edge contamination has been demonstrated up to 1.47 times the theoretical critical Reynolds number based on the attachment line momentum thickness. Investigations have been carried out into the effect of changes in incidence, suction quantity and unit Reynolds number on the chordwise position of transition. Experimental and calculated boundary layer profiles at the same conditions have been compared and a good correlation between them has been obtained. A qualitative assessment of environmental and production difficulties likely to be encountered on an aircraft using this system, has also been made. Author

N67-10748*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EFFECTS OF JET PLUMING ON THE STATIC STABILITY OF BALLISTIC BODIES AT A MACH NUMBER OF 6.0
Robert J. Mc Ghee Washington, NASA, Nov. 1966 27 p refs
(NASA-TN-D-3698) CFSTI: HC $2.00/MF $0.50 CSCL 01A

An investigation was conducted in a 2-ft hypersonic facility at a Mach number of 6.00 to determine effects of jet pluming on the static stability of ballistic bodies. Effects of forebody and afterbody geometry as well as fins and flares were investigated. The ratio of jet pressure to free-stream static pressure ranged from jet-off conditions to about 7000. The model angle of attack varied from $-2°$ to $8°$. Test Reynolds number based on body diameter was approximately 0.07×10^6. The results indicate that increasing the jet-pressure ratio resulted in shock-induced separation accompanied by significant decreases in both normal-force-curve slopes and static stability. Increasing the angle of attack resulted in the stabilizing surfaces recovering a large measure of their effectiveness with corresponding increases in stability; however, for large jet-pressure ratios little or no improvement resulted at the highest angle of attack. For the $30°$ conical forebody and flare afterbody, increasing the length of the centerbody resulted in a decrease in the jet-plume-induced destabilizing contribution. For any forebody, the finned afterbody reduced the variations in center of pressure to about 1 body diameter for the entire range of jet-pressure ratios. Changes in center of pressure were more abrupt in the low jet-pressure-ratio range for either the cylindrical or flared afterbody compared with changes for the finned afterbody. Author

N67-10747*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC AERODYNAMIC INVESTIGATION OF TENSION SHELL AND BLUNTED 100° CONICAL SHAPES FOR UNMANNED ENTRY VEHICLES
Charles D. Harris Washington, NASA, Nov. 1966 30 p refs
(NASA-TN-D-3700) CFSTI: HC $2.00/MF $0.50 CSCL 01A

An experimental investigation of a spherically blunted $100°$ cone and two tension shell configurations with varying nose-bluntness ratios for use in unmanned entry into low-density planetary atmospheres has been conducted at Mach numbers from 0.30 to 1.20 and at angles of attack from approximately $0°$ to $40°$. The results show that the models were longitudinally stable, with centers of pressure located rearward of the base at all test conditions. The tension shell configurations exhibited substantially higher axial-force coefficients than the $100°$ cone although the variation of axial-force coefficient with Mach number at zero angle of attack was similar for all configurations. An increase in tension shell body length resulted in a reduction of the axial-force coefficients and a more forward center-of-pressure location. Variation in nose bluntness had no significant effect on the longitudinal aerodynamic characteristics of the tension shell configurations. Author

N67-10748*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A MODEL OF A SUPERSONIC FIGHTER-BOMBER AIRPLANE WITH EXTERNAL FUEL TANKS AND OTHER MODIFICATIONS
James C. Ferris Washington, NASA, Nov. 1966 57 p refs
(NASA-TN-D-3701) CFSTI: HC $2.50/MF $0.50 CSCL 01A

An investigation was made of the static stability characteristics of a 1/22-scale model of a supersonic fighter-bomber airplane. The configurations included a short single-place model, a long two-place model, and models with external fuel tanks, a larger vertical tail, wing-leading-edge-flap deflections, and an afterbody fuel tank. The longitudinal aerodynamic characteristics were determined through an angle-of-attack range from $-4°$ to $23°$ at an angle of sideslip of $0°$, at Mach numbers from 0.60 to 1.20. The models were investigated through a sideslip range from $-4°$ to $15°$ at fixed angles of attack of $0°$, $5°$, $10°$, and $15°$. All configurations were investigated with internal flow in the model. The configurations were longitudinally stable through the normal angle-of-attack range; however, a pitch-up occurred at an angle of attack of $21°$ at a Mach number of 0.80 with the single-place model. The external fuel tanks caused a shift in trim to higher lift coefficients and substantial increases in drag. The configurations were generally laterally stable, although substantial losses in directional stability occurred at high angles of attack. Author

N67-10795*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SUBSONIC LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF A 40° SEMIAPEX ANGLE CONICAL REENTRY CONFIGURATION
W. Pelham Phillips Washington, NASA, Nov. 1966 14 p refs
(NASA-TN-D-3718) CFSTI: HC $1.00/MF $0.50 CSCL 01A

A wind-tunnel investigation has been made to determine the subsonic longitudinal aerodynamic characteristics of a $40°$ semiapex angle conical reentry configuration having several nose-to-base radii bluntness ratios. The longitudinal center-of-pressure locations near zero angle of attack were aft of the base for all nose bluntness ratios over the subsonic Mach number range investigated. The only notable effect of increasing nose bluntness for a given Mach number was a slight rearward movement of the center-of-pressure location relative to that of the sharp apex configuration. Author

N67-10924# Northrop Corp., Hawthorne, Calif. Norair Div.
HIGH LIFT SURFACE DESIGN PROCEDURES EXPERIMENTAL VERIFICATION. VOLUME III: WIND TUNNEL TESTS
F. W. Peitzman May 1966 194 p
(Contract NOw-65-0380-c)
(NOR-66-206; AD-639191) CFSTI: HC $7.00/MF $1.50

The volume presents the results of a low speed wind tunnel test of four half-span wing models. The primary objective of the test was to obtain experimental data on wings developed by a high lift surface computer program. Two wings designed by this method, one high and one low lift, were tested. A secondary objective of the test was to determine the feasibility of simulating the high lift wing by flaps on the low lift wing and, conversely, simulating the low lift wing by flaps on the high lift wing. This involved an additional two models for a total of four Author (TAB)

N67-10936# Northrop Corp., Hawthorne, Calif. Norair Div.
HIGH LIFT SURFACE DESIGN PROCEDURES EXPERIMENTAL VERIFICATION. VOLUME II: THEORETICAL DESIGN AND ANALYSIS
J. R. Stevens, J. W. Mc Donald, and J. W. Headley May 1966 126 p refs
(Contract NOW-65-0380-c)
(NOR-66-206; AD-639289) CFSTI: HC $4.00/MF $1.00

The development of four wings which were designed to have specific aerodynamic requirements is described. The wings designed were: a high lift wing, a low lift or cruise wing, both of which were smooth, and two flapped wings which were approximations of the smooth wings. TAB

N67-11050# Northrop Corp., Hawthorne, Calif. Norair Div.
HIGH LIFT SURFACE DESIGN PROCEDURES EXPERIMENTAL VERIFICATION. VOLUME I: SUMMARY AND EVALUATION
James R. Stevens, James W. Mc Donald, and Jack W. Headley 16 Aug. 1966 76 p refs
(Contract NOw-65-0380-c)
(NOR-66-206; AD-639255) CFSTI: HC $3.00/MF $0.75

The main purpose of this work was to determine the performance gains of wings designed for optimized high lift by a new design procedure based on lifting surface theory for wings in steady subsonic flow. The theoretically predicted performance of the wings is compared with the wind tunnel test results and comparisons are made between these results and the performance of wings designed by other methods. The results indicated that the optimized high lift wing had greater lift to drag ratios in the high lift range of operation than cruise wings using high lift devices. The optimized high lift wing exhibited results comparable to the cruise wing when it was flapped to approximate the mean surface slope distribution of the cruise wing. The results also verified the computer programs and demonstrated that the new design procedure can be used for a wide range of lift coefficients. It is concluded that this new design procedure is superior to the old cut and dry methods. Also, if high lift is of prime importance in a mission, the penalties are less if the wing is designed for optimized high lift and flapped for low lift Author (TAB)

N67-11145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF DETERMINING THE AERODYNAMIC CHARACTERISTICS OF BODIES IN A FREE-MOLECULAR FLOW
L. A. Vasil'yev and L. I. Travnikova 28 Jun. 1966 6 p Transl. into ENGLISH from Russian Patent No. 168030 (Appl. No. 886744/40-23, 12 Mar. 1964) 2 p
(FTD-TT-65-1935; AD-639155) CFSTI: HC $1.00/MF $0.50

A model of the body is radiated by light flux from a little aperture and one measures the indicatrix of the dispersion of the light by the surface of the model while simultaneously selecting the surface of the model in such a way that the characteristics of the reflection of the light from it would be the same as the characteristics of the reflection of the molecules of the medium in which the body is flying. Author (TAB)

N67-11146# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD FOR MODELING THE PROFILES ON WINGS AND PROPELLERS
G. A. Ryazanov and V. V. Kopeyetskiy 28 Jun. 1966 5 p Transl. into ENGLISH from Russian Patent no. 168459 (Appl. no. 819243/26-24, 7 Nov. 1963) 1 p
(FTD-TT-65-1936; AD-639151) CFSTI: HC $1.00/MF $0.50

The object of the invention is a method of modeling the profiles of wings and propellers based on the method of magnetohydrodynamic analogy. To determine the speeds effected, the vortical system of the wing or propeller, determined by a given drop in pressures, is substituted by discrete vortices with constant circulation and modeled by one wire. Author (TAB)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N67-10038# Royal Aircraft Establishment, Farnborough (England).
MODELS WITH FLAPPING WINGS
G. Vasil'ev Jun. 1966 68 p refs Transl. into ENGLISH of the book "Modeli s Mashushchimi Kryl'yami" Moscow, Izd. Dosaaf, 1960
(RAE-LIB-TRANS-1172) CFSTI: HC $3.00/MF $0.75

Designs of successful and interesting models relating to aircraft with flapping wings are discussed. Simple basic experiments for beginners, and flying models for the more experienced are described. Author

N67-10184*# National Aeronautics and Space Administration, Washington, D. C.
PROJECT STUDY OF POSTAL MISSILES
Engins Matra and Giravions Dorand Apr. 1963 138 p Transl. into ENGLISH of the book "Avant Project D'Engin Postal" France, Jan. 1962
(NASA-TT-F-8458) CFSTI: HC $3.00/MF $1.00 CSCL 16D

The general aerodynamic properties and the guidance equipment for the postal missile are presented. The design, construction, testing, and cost analysis are reported. Missile specifications include data on configuration, propulsion unit, arrangement and handling of load. A detailed description of the rotor is given, and an outline covers the guidance during different phases of flight, operational principles, and equipment required. Technical appendixes are included on: reference frames for guidance, analog computer used for descent and approach phases, piloting devices controlling flight during cruising and descent phases. R.U.

N67-10225*# National Aeronautics and Space Administration, Washington, D. C.
METHOD FOR THE DETERMINATION OF THE NOISE FROM TURBOJET AIRCRAFT ON TAKE-OFF TRAJECTORIES [METHODE DE CALCUL DU BRUIT PRODUIT PAR DES AVIONS A REACTION SUR LEUR TRAJECTOIRE DE DECOLLAGE]
Michel Kobrynski Oct. 1966 65 p refs Transl. into ENGLISH from O.N.E.R.A. Rept. TN-81, 1965 p 1-65
(NASA-TT-F-10351) CFSTI: HC $2.50/MF $0.75 CSCL 01C

The approximate determination of the maximum sound pressure of turbojet aircraft on the ground or in subsonic flight may be carried out from the laws of jet noise emissions using the generalized spectrum of the sound pressure and the directivity of the acoustic rays. One method is applicable when the jet Mach number is smaller than 2 (with respect to the velocity of sound in the atmosphere) and takes into account the theoretical variation of the acoustic power which is proportional to V_j^2, where V_j is the jet velocity. If the jet is in motion, as is the case in flight, the basic parameter is the difference $V_j - V_a$ of the jet and aircraft velocities. A second method is also discussed. Author

N67-10352# George Washington Univ., Washington, D. C.
A SYSTEMATIC METHOD FOR DETERMINING THE BEST ALTIMETER DISPLAY FOR HIGH PERFORMANCE AIRCRAFT
Howard Garfield Heininger, Jr. (M.S. Thesis) 22 Feb. 1966 192 p refs
(AD-638318) CFSTI: HC $5.00/MF $1.00

The methodology was implemented by conducting static and dynamic laboratory testing. The results of the testing were thoroughly analyzed and presented to the Air Force and the Navy. As a result, the Air Force and the Navy standardized upon the counter-drum-pointer altimeter display which should save approximately $20,000,000 in procurement, logistics, and maintenance costs. The display should also reduce the number of aircraft accidents caused by altimeter reading errors. The methodology was further refined and extended so that it can be utilized in future flight display developments and evaluations. Author (TAB)

N67-10377# Royal Aircraft Establishment, Farnborough (England).
THE DESIGN AND FLIGHT TESTING OF A TAKE-OFF AND OVERSHOOT DIRECTOR
D. E. Fry, K. Burden, and M. R. Green Mar. 1966 61 p refs
(RAE-TR-66083; AD-637944) CFSTI: HC $3.00/MF $0.75

The object of the work was to assess a particular type of control law for a take-off and overshoot director. The basic law is simple and only two internal sensors are used. A twin-seat Hunter incorporating a dual head-up display system was used for the flight trials. Several versions of the director were built, flight tested and results analysed. Detailed description of the computer is given. The results indicate that the system could well form the basis for a complete take-off director. Author (TAB)

N67-10402# Federal Aviation Agency. Test and Evaluation Div.
DISCUSSION OF THE UTILITY OF AVAILABLE TECHNIQUES FOR MEASURING AIRCRAFT NOISE AND PREDICTING COMMUNITY RESPONSE Final Report
Thomas H. Green May 1966 20 p refs
(RD-66-31; AD-638491) CFSTI: HC $1.00/MF $0.50

Perceived Noise Level (PNdB), a technique for measuring aircraft noise, is calculated from measured noise levels and correlates well with subjective judgments in terms of annoyance and noisiness. The discussion considers the effects of physical laws and environmental factors which attenuate, both predictably and variably, the sound pressures reaching the ground. The effects of psychological factors which influence subjective judgments are also discussed. It is suggested the effect of these factors is such that Perceived Noise Level is of useable precision and additional refinement would be superfluous. The procedure for predicting community response to airport operations using Composite Noise Ratings is discussed. Actual measurement of aircraft noise is not required. Noise contours of aircraft operations exist, and these are used in conjunction with airport operations data in a simplified procedure to derive a prediction of community response. In an effort to improve the sensitivity of the prediction process to local conditions, a separate study was made of the decision-making process on the municipal level. A definitive pattern could not be discerned and it was concluded the existing predictive procedure cannot be made more sensitive to communtiy reaction at this time. Author (TAB)

N67-10408# Air Force Flight Test Center, Edwards AFB, Calif.
FLIGHT TEST ENGINEERING HANDBOOK Technical Report, Jun. 1964–Jan. 1966
Russel M. Herrington, Paul E. Shoemacher, Eugene P. Bartlett, and Everett W. Dunlap Jan. 1966 710 p refs Revised
(AFFTC-TR-6273; AD-636392) CFSTI: HC $10.10/MF $3.00

Methods of obtaining flight test data for reciprocating engine aircraft (including helicopters) and turbojet aircraft are presented together with various methods of data analysis and data presentation. Correction of aircraft performance to standard conditions is included, as are detailed derivations of correction factors and performance parameters. Numerous graphs and charts containing information required by and useful to the flight test engineer are presented, together with sample data reduction forms and sample flight test programs. Author

N67-10435# Technology, Inc., Dayton, Ohio.
A STRUCTURAL FLIGHT LOADS RECORDING PROGRAM ON CIVIL TRANSPORT HELICOPTERS
Cyril G. Peckham, F. Joseph Giessler, and Joseph F. Braun Jul. 1966 93 p
(Contract FA-WA-4590)
(FAA-ADS-79)

To conduct a pilot flight loads program on a transport helicopter, the following parameters of a Vertol 107-II helicopter operated by New York Airways were measured: airspeed, altitude, vertical load factor, pitch rate, rotor rpm, and engine torque. Calculations included the running gross weight and the rate of climb. The data were grouped into mission segments of takeoff and ascent, cruise, descent, flare and landing, and hover. After determining the best method of data presentation, the data were sorted by parameter ranges. The primary presentation is in the form of bivariate and trivariate tables showing the time spent in each data range. Some of the more significant data effects are presented as histograms. The vertical load factor and pitch rate data are presented as exceedance and probability curves. Author

N67-10484# Army Aviation Materiel Labs., Fort Eustis, Va.
CH-54A SKYCRANE HELICOPTER FLIGHT LOADS INVESTIGATION PROGRAM Engineering Laboratory Report
Joseph F. Braun, F. Joseph Giessler (Technol., Inc.), David Chestnutt, and Louis R. Bartek Jun. 1966 183 p
(USAAVLABS-TR-66-58; AD-638364) CFSTI: HC $5.00/MF $1.00

The report deals with the analysis of the 110.4 hours of CH-54A Skycrane data. Century 409B oscillograph recorders were used to collect the parameters measured, including airspeed, altitude, vertical acceleration at center of gravity, main rotor rpm, longitudinal cyclic stick position, collective stick position, outside air temperature, torque on each engine, and gas producer rpm on each engine. Barometric pressure and takeoff-and-landing gross weight estimates were also recorded as supplemental information. The flight data were divided into four categories by mission: ascent, maneuver, descent, and steady state. The aircraft were performing their normal mission functions during the period in which the data were collected. Time history tables, histograms, peak counts, and exceedance curves were generated from the data. As a result of this study, designers now have a limited sample of conditions experienced by four CH-54A aircraft in the field. Author (TAB)

N67-10508# Hughes Tool Co., Culver City, Calif.
XV-9A HOT CYCLE RESEARCH AIRCRAFT PROGRAM Summary Report, 29 Sep. 1962–15 Mar. 1965
S. Cohan and N. B. Hirsh Ft. Eustis, Va., Army Aviation Mater. Labs., Jun. 1966 78 p refs
(Contract DA-44-177-AMC-877(T))
(HTC-AD-65-27; USAAVLABS-TR-66-10; AD-638366) CFSTI: HC $3.00/MF $0.75

The report summarizes a research program covering the design, fabrication, and test of the XV-9A Hot Cycle Research Aircraft. Discussion of the program is broken into five major areas: design and fabrication, engine and whirl tests, component testing, ground tests, and flight tests. During the program, conducted from 29 September 1962 through 15 March 1965, the flight feasibility of the Hot Cycle rotor was successfully validated Author (TAB)

N67-10571# Wissenschaftliche Gesellschaft fur Luft- und Raumfahrt, Cologne (West Germany).
REPORT OF THE MEETING OF THE COMMITTEE ON AEROMECHANICS AND FLIGHT CONTROL AIR COMMAND ON 19 JULY 1963 IN BRUNSWICK [BERICHT UEBER DIE SITZUNG DER FACHAUSSCHUESSE FLUGMECHANIK UND FLUGREGELUNG FLUGFUEHRUNG AM 19. JULI 1963 IN BRAUNSCHWEIG]
11 Jan. 1965 89 p refs In GERMAN and ENGLISH
(D LR-MITT.-65-02) CFSTI: HC $3.00/MF $0.75

Articles on the following subjects are presented: (1) reliability of VTO L flight stabilization systems; (2) improvements in the reliability of flight control systems; (3) principles of fault analysis applicable to a flight control system; (4) concepts and realization of reliable flight control systems; (5) application of the adaptive principle in improving the reliability of flight control systems; (6) achieving reliability in VTOL autocontrol systems; and (7) automatic control of VTOL aircraft. Diagrams, illustrations, and discussions by participants of the meeting are included. Transl. by K.W.

N67-10579# Royal Aircraft Establishment, Farnborough (England).
PILOTING A HEAVY AIRCRAFT DURING TAKE-OFF [PILOTIROVANIE TYAZHELOGO SAMOLETA NA VZLETE]
V. Kovalev and F. Sklyanskii May 1966 19 p refs Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 11, 1964 p 50–59
(RAE-LIB-TRANS-1144) CFSTI: HC $1.00/MF $0.50

In general terms, some of the problems associated with the take-off of jet transport aircraft are described. The differences between such aircraft and piston-engine types are pointed out. Author

N67-10595# McDonnell Aircraft Corp., St. Louis, Mo.
TECHNICAL AND ECONOMIC EVALUATION OF AIRCRAFT FOR INTERCITY SHORT-HAUL TRANSPORTATION, VOLUME II Final Report
Apr. 1966 170 p refs
(Contract FA-65WA-1246)
(FAA-ADS-74, Vol. II; E390, Vol. II)
For abstract see N67-10599 01-02.

N67-10599# McDonnell Aircraft Corp., St. Louis, Mo.
TECHNICAL AND ECONOMIC EVALUATION OF AIRCRAFT FOR INTERCITY SHORT-HAUL TRANSPORTATION, VOLUME I Final Report Apr. 1966 44 p
(Contract FA-65WA-1246)
(FAA-ADS-74; Vol. I, E390, Vol. I)

This report evaluates the potential airline use of STOL/VTOL aircraft to serve intercity short haul travelers. The air travel market in the California Corridor (between Los Angeles and San Diego on the south and Sacramento and San Francisco on the north) was used for the study but the results would be generally applicable to other areas. Based on 1970 technology, four STOL and VTOL aircraft configurations were designed as 60-, 90-, and 120-passenger transports, and developed for lowest operating costs for a 500-mile stage length. A conventional jet transport was used as a base of reference and a conventional helicopter was included for comparison. The special STOL/VTOL airports were located for passenger convenience and acceptable noise levels for the surrounding areas. To evaluate STOL/VTOL economic viability, STOL and VTOL airline service was simulated in the California Corridor in 1975 and 1980, and then compared with the conventional jet simulation in those years. It was found that the time savings and convenience provided by either STOL or VTOL airline service would enable STOL or VTOL to capture a substantial share of the short-haul air travel market when combined in a system with conventional jets, and would induce additional air travel. This system would give a satisfactory return on investment. Author

N67-10750*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
FULL-SCALE WIND-TUNNEL INVESTIGATION OF A VTOL AIRCRAFT WITH A JET-EJECTOR SYSTEM FOR LIFT AUGMENTATION
Jerry V. Kirk and David H. Hickey Washington, NASA, Nov. 1966 51 p refs
(NASA-TN-D-3725) CFSTI: HC $2.00/MF $0.50 CSCL 01C

Aerodynamic characteristics of a VTOL aircraft were examined from hover up to and including wing-supported flight. Ejector performance was measured statically and with forward speed. The maximum static augmentation ratio measured was 1.19. The ratio of ejector thrust with forward speed to static ejector thrust increased with forward speed. In general, the aircraft has nearly neutral longitudinal stability at angles of attack below wing stall, but above wing stall, pitch-up was severe. Lateral and directional stability were positive. Control power for trim in transition appeared to be adequate except for recovering from post stall pitch-up. Results from tests in a full scale wind tunnel, in flight, and in a small scale wind tunnel generally agree well. Author

N67-11006# David Taylor Model Basin, Washington, D. C.
SURVEY OF PRESENT STATE OF TECHNOLOGY AND PRACTICAL EXPERIENCES WITH AIR-CUSHION VEHICLES
Basil V. Nakonechny Jul. 1966 54 p refs
(DTMB-2203; AD-637135) CFSTI: HC $3.00/MF $0.75

This report presents a survey of the present state of technology as well as practical experiences relating to design and operation of air-cushion vehicles (ACVs). Topics include a brief description of vehicle types and basic-engineering principles, characteristics of existing vehicles and those of the near future, existing and potential main machinery and propulsion systems, and possible technological trends in critical areas. No attempt is made to discuss the potential of ACVs for naval application; rather, the technologic base is identified so as to make available to naval architects information supplemental to their conceptual design studies. On the basis of available information one can conclude that air-cushion vehicles of 1,000 tons and larger will not be available for open ocean operations within the next 2 to 3 years. (Author) TAI

N67-11116# Federal Aviation Agency, Washington, D. C. Library Services Div.
AIRCRAFT NOISE AND SONIC BOOM, SELECTED REFERENCES Bibliographic List No. 13
Louis K. Annus, comp. Oct. 1966 112 p refs

Various aspects of design problems, operational experiences, and human responses to aircraft noise and sonic boom are covered in a partially annotated bibliography on aircraft noise and sonic boom. References are included on meteorological effects of and structural responses to sonic boom, a section is devoted to helicopter noise, and personal author and corporate source indexes are tabulated for all of the references. M.W.R.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N67-10261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPACE POWER SYSTEMS ADVANCED TECHNOLOGY CONFERENCE
Washington, NASA, 1966 295 p refs Conf. held in Cleveland, 23–24 Aug. 1966
(NASA-SP-131) CFSTI: HC $3.75/MF $1.50 CSCL 10B

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N67-10262*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
POWER SYSTEMS IN PERSPECTIVE
Bernard Lubarsky *In its* Space Power Systems Advanced Technol. Conf. 1966 p 1–8 (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

Progress in space power systems technology is briefly summarized and illustrated with attention to power systems currently in use and advanced systems. The battery, hydrogen-oxygen fuel cell, solar photocell, and the radioisotope thermoelectric generator are presently being used. Advanced power systems not in use are the Brayton-cycle, gas-turbine, the Rankine-cycle, vapor-turbine, and the thermionic emitter. The most promising heat sources are solar, isotopic, and the reactor SNAP-8. S.P.

N67-10263*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BATTERIES AND FUEL CELLS
Harvey J. Schwartz, J. Stewart Fordyce, Robert B. King, James M. Mc Kee, Daniel G. Soltis et al *In its* Space Power Systems Advanced Technol. Conf. 1966 p 9–51 refs (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

Efforts to improve electrochemical systems in areas of energy density, life, temperature capability, and reliability are related. Improved performance and efficiency in the nickel-cadmium and silver-zinc cells are discussed. In the nickel-cadmium battery the persistent problem considered is loss of charge on the nickel-oxide electrode on standing at open circuit. Shortcomings of the silver-zinc couple are listed as soluble electrodes, separators not inert to their environment, and zinc electrode susceptible to dendritic growth. High- and low-temperature batteries and methods of coping with extreme thermal environments are described as the main problems in exploration of the surfaces of Mercury, Venus, and Mars. Nonaqueous batteries that offer promise of major increases in energy density are considered on the criteria of good stability and conductivity and low viscosity. Practical test results involving anodes, cathodes, and electrolytes are illustrated in tabular form. Development of electrode materials capable of high power output and long life is termed the critical area with respect to fuel cells. S.P.

N67-10264*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CONVENTIONAL AND THIN-FILM SOLAR CELLS
Andrew E. Potter, Jr. *In its* Space Power Systems Advanced Technol. Conf. 1966 p 53–72 refs (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

Improvement of cell fabrication methods, radiation damage resistance, film cells, and high-power arrays is described for thin-film and conventional solar cells. Efforts to improve resistance of silicon cells to radiation damage are focused on improving the blue response of the solar cell. The status of the cadmium sulfide cell is discussed in considerable detail. Stability is defined as the main problem in storage degradation, humidity damage, thermal cycling failure, and ultraviolet-light damage. The construction of solar power arrays that yield up to 50 kilowatts is described. The silicon cells used in these high-power arrays are efficient, stable, and workable in the space environment, but very expensive. Development of flexible rollup arrays is also mentioned. S.P.

N67-10265*# National Aeronautics and Space Administration, Washington, D. C.
ISOTOPES AND ISOTOPE THERMOELECTRIC GENERATORS
Fred Schulman *In* NASA. Lewis Res. Center Space Power Systems Advanced Technol. Conf. 1966 p 73–93 refs (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

Isotope properties, thermoelectric conversion, thermoelectric generators, and missions which illustrate the possibilities of using isotope power systems are discussed. Advantages and disadvantages of isotopic power are tabulated, and a brief history of isotopic-power generator development is presented. The figures of merit for lead telluride materials and silicon–germanium alloys as a function of temperature are compared. The combination of heat pipes with thermionic converters is described as a means of improving conversion efficiency in low-power generators. The heat pipe is an excellent thermal control device that can transfer heat from the isotope heat source to the cathode of a converter. Nimbus B mission employing two SNAP-19 generators and the SNAP-27 generator, which will provide power for scientific experiments in the Apollo lunar surface package, are mentioned to illustrate the use of isotopic power. The availability of isotopes, their production, and their cost are briefly considered. S.P.

N67-10266*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BRAYTON CYCLE TECHNOLOGY
Warner L. Stewart, William J. Anderson, Daniel T. Bernatowicz, Donald C. Guentert, Donald R. Packe et al *In its* Space Power Systems Advanced Technol. Conf. 1966 p 95–145 (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

Application of the Brayton cycle to a space power system is considered, and its features are illustrated by comparison with the Rankine cycle. Areas compared are cycle efficiency at low temperature ratios, the radiator area, pressure level effects, and molecular weight effects. A technology discussion involving the performance and mechanical integrity of both rotating and heat transfer components is included. Rotating component areas considered are turbomachinery, the electric generator, gas bearings, and packaging. Problems connected with the Brayton space power generating system considered are the alternator speed control, system power level control, and system start. Major points brought out in discussions were that relatively large radiator areas are

required, acceptable performance can be obtained from the turbomachinery, and control of pressure level through inventory modulations is a valuable tool in the control of power output.
S.P.

N67-10271*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATIONS OF POWER SYSTEMS TO SPECIFIC MISSIONS
Bernard Lubarsky and Lloyd I. Shure *In its* Space Power Systems Advanced Technol. Conf. 1966 p 269–285 (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

Proposed space power systems are discussed in terms of typical mission applications. A comparison of the use of these new power plants is made with existing systems, such as photocells. The missions discussed begin with near Earth orbital, and progress outward to the planetary missions. A summary of the weights and area characteristics of solar power systems for manned orbiting stations is shown. The advantages of three reactor power systems are assessed; namely, the Rankine, Brayton, and thermionic systems. Cost factors in the selection of a power system for a particular mission are also examined. Throughout the discussion, it is emphasized that the power plants depend upon the mission. Energy storage requirements, the amount of available sunlight, shielding requirements and the extent to which lunar material can be used all have their effect on the attractiveness of the power plant selected. The general conclusion that there is a place for both solar and nuclear power systems in future missions is drawn.
H.S.W.

N67-10318# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
RESEARCH ON EXHAUST GAS EFFECTS ON HEAT EXCHANGERS Final Report, Mar. 1965–Jul. 1966
Charles B. Mort Wright-Patterson AFB, Ohio, Systems Eng. Group, Jul. 1966 144 p ref
(Contract AF 33(615)-2471)
(SEG-TR-66-30; HSER-4075; AD-637952) CFSTI: HC $4.00/MF $1.00

The objective of the research program was to determine fouling effects of gas turbine exhaust gases upon heat exchangers in heat recovery systems. The program included the design, manufacture, testing and evaluation of various heat exchangers. The parameters studied for effects were gas temperature and velocity, metal temperatures, fuel-air ration and fuel type. Also included in the program were investigations of cleaning techniques, surface coatings, distribution, surface roughness, inclination, configuration geometries, startup and shutdown effects, and analytical studies of transient and differential heat stresses. The overall conclusions are presented as design parameters for incorporation of fouling factors into the analysis of waste heat exchangers. Evaluation of results showed that gas velocity had the predominant effect upon fouling--the lower the velocity, the greater the fouling. Gas temperature effects were significant with more fouling had very little effect on the degree of fouling. As the fuel-air ratio increased, the fouling increased. Combat gasoline, a leaded fuel, fouled at higher rates than JP-4 fuel
Author (TAB)

N67-10342# IIT Research Inst., Chicago, Ill.
PASSIVE DEVICES FOR PROVIDING CONTINUITY OF ELECTRIC POWER Final Report, 21 Mar.–21 Jun. 1966
J. L. Radnik, P. K. Kawecki, and J. N. Van Scoyoc Port Hueneme, Calif., Naval Civil Eng. Lab., Jul. 1966 76 p
(Contract NBy-62200)
(CR-67.003; AD-637849) CFSTI: HC $3.00/MF $0.75

In an engineering and experimental analysis of passive devices for providing continuity of electric power, a parallel resonant circuit used in conjunction with a step-up transformer and connected in shunt with the critical load was shown to be feasible. An experimental load of one kilowatt was adequately supplied during interruptions of one-half cycle. In addition, an isolation circuit was developed, which can be used to isolate the critical load and resonant circuit from other loads and the source in case of source failure.
Author (TAB)

N67-10423# Library of Congress, Washington, D. C. Aerospace Technology Div.
ELECTROMECHANICAL SYSTEMS Surveys of Foreign Scientific and Technical Literature, 1963–1966
20 Jun. 1966 57 p* refs Sum. of Data
(ATD-66-74)

This summary of data is based on Soviet-Satellite open sources published 1963–1966. The report consists of 24 abstracts and translations which are divided into five sections: I. Fluid computers (1 translation); II. Gyroscopic systems and integrators (6 abstracts); III. Electromechanical instruments (1 translation, 3 abstracts); IV. Accelerometers (2 translations, 5 abstracts) V. Mechanical systems (6 abstracts). The translation in Section I concerns a conference on pneumohydraulic automation. Section II includes information on gyroscopic integrators and inertial systems. The translation in Section III concerns an investigation of an electromechanical trigger regulator with a potential actuator. Other devices covered include a change-over switch for pneumatic signals, a magnetohydrodynamic transducer, and a semiconductor miniature pressure sensor. Section IV discusses various types of accelerometers including string accelerometers and a compensating-type integrating accelerometer. In Section V the dynamic model of a clock and the theory of clock springs are investigated.
Author

N67-10582# Army Electronics Labs., Fort Monmouth, N. J.
ORGANIC DEPOLARIZED PRIMARY BATTERIES Progress Report
Joseph C. Pawlak Jul. 1966 28 p refs
(ECOM-2733; PR-2) CFSTI: HC $2.00/MF $0.50

A number of investigations were performed on Mg/Mg(C1O4)2/m-DNB A-size and D-size organic depolarized primary cells. Formulation studies showed that the cathodic wetness level and the type of carbon black employed have a significant effect upon cell performance. Best overall cell service is obtained with cells employing a cathodic mix incorporating a high surface area specialty carbon black at a moderate wetness level. The use of the maximum tolerable wetness level resulted in highest initial cell services, but had a detrimental effect upon shelf life with use of one of the specialty carbon blacks evaluated. Information is presented on the background and the current status of the specialty carbon black required for use in the organic depolarized primary battery system
Author (TAB)

N67-10752*# Fairchild Hiller Corp., Rockville, Md.
DEVELOPMENT OF A THERMIONIC DIODE CONTROLLED POWER SYSTEM
H. Dean Venable Washington, NASA, Nov. 1966 112 p refs
(Contract NAS5-5890)
(NASA-CR-642) CFSTI: HC $3.00/MF $0.75 CSCL 10B

Details on the design, development, and fabrication of a dual channel analog system are reported. The low power chain is powered by four 12.5 watt thermionic diodes delivering a total of 50 watts at 2 volts. The high power chain operates from a 5 volt source and delivers 1000 watts at 56 volts, and is slaved to the thermionic diode chain. It was concluded that the thermionic diode controlled power system with high power, high efficiency, high reliability, and low input voltage power conditioning is feasible. It is pointed out that the system can be modified to work with other power sources such as solar cells, fuel cells, and thermoelectric generators to amplify their output power levels while maintaining their electrical characteristics.
N.E.N.

N67-10799*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL PERFORMANCE EVALUATION OF A RADIAL-INFLOW TURBINE OVER A RANGE OF SPECIFIC SPEEDS

Milton G. Kofskey and Charles A. Wasserbauer Washington, NASA, Nov. 1966 18 p refs

(NASA-TN-D-3742) CFSTI: HC $1.00/MF $0.50 CSCL 10A

An experimental investigation was made to determine the effect of specific speed on efficiency for a 4.59-inch radial-inflow turbine. The range of specific speeds investigated (72 to 108) at equivalent design speed and pressure ratio was obtained by changing volume flow, based on rotor exit conditions. Changes in volume flow were accomplished by the use of stators having throat areas nominally 50, 75, 100, and 125 percent of design. The turbine was operated with air as the working fluid. Maximum total and static efficiencies were obtained over the specific speed range of about 80 to 90. The peak total and static efficiencies were 0.91 and 0.87, respectively, for the 75-percent configuration. An understanding of the losses which contributed to the variation of turbine performance with specific speed at design blade-jet speed ratio was made possible by an analysis which determined the magnitude of the various losses for each configuration. Stator loss was the predominant contributor to the decrease in efficiency as specific speed was reduced from a value of 86. Rotor incidence and viscous losses were the primary contributors to the decrease in performance when specific speed was increased above the value of 90. Stator exit static-pressure measurements showed that, at equivalent design speed and pressure ratio, rotor reaction increased as specific speed increased. Author

N67-10895*# Rocketdyne, Canoga Park, Calif.

EVALUATION AND DEMONSTRATION OF THE USE OF CRYOGENIC PROPELLANTS (O_2-H_2) FOR REACTION CONTROL SYSTEMS Quarterly Report, 1 Apr.–1 Jul. 1966

N. Weber, N. Rodewald, E. Prono, G. Haroldsen, F. Hunter et al 13 Jul. 1966 82 p refs

(Contract NAS3-7941)

(NASA-CR-79704; R-6342-4; QR-4) CFSTI: HC $3.00/MF $0.75 CSCL 21H

In the thrustor design and fabrication effort, an analytical model was developed, incorporated in a computer program, and its operating characteristics determined. This simulation program was used to evaluate the pneumatic and thermal transient responses expected in the experimental hardware and flight-type design. The sensitivity of the operating characteristics to temperature and pressure perturbations was examined for various injector pressure drops, catalyst bed pressure drops, and feed pressure levels. Results show a ±R temperature band, and a ±0.5 psia pressure band as a probable operating limit. A subsystem analysis of the conditioner was undertaken, in which consideration was given to control system alternatives and the physics of the system for inclusion in a system simulation. Control system alternatives were based on the pressure deadband requirement determined in the thrustor effort. Detailed heat and material balances on the proposed experimental system were obtained, to serve as the design bases for the individual components. M.G.J.

N67-10926# IIT Research Inst., Chicago, Ill. Inst. of Gas Technology.

JP-4 FUELED MOLTEN CARBONATE FUEL CELLS, JANUARY 1–JULY 1, 1966

L. G. Marianowski Jul. 1966 24 p refs

(Contract DA-44-009-AMC-1456(T))

(Rept.-1; AD-639215) CFSTI: HC $1.00/MF $0.50

Sixteen single molten carbonate fuel cells were assembled and tested. Nine of these were assembled in the alumina tube enclosures and the remaining seven were made in metal flange enclosures. The areas of the alumina tube cells are 3 and 45 sq cm, and the area of the metal flange enclosure cells is 31.7 sq cm. A summary of the conditions used in all 16 tests is given. All tests used 20% dense fiber nickel anodes and paste electrolytes. TAB

N67-10934# Leesona Corp., Great Neck, N. Y. Leesona Moos Labs.

ZINC/AIR HIGH ENERGY DENSITY RECHARGEABLE ENERGY STORAGE SYSTEM Interim Report, Jan. 6–May 6, 1966

M. A. Vertes, E. G. Katsoulis, J. E. Oxley, and K. Alfredson Aug. 1966 57 p refs

(Contract DA-44-009-AMC-1469(T))

(AD-639609) CFSTI: HC $3.00/MF $0.75

Electrically rechargeable Zn/Air energy storage systems were investigated. Two alternative systems, one with static and one with recirculating electrolyte, were studied. The ability of both systems to sustain charge/discharge cycling was shown experimentally. Parallel analytical studies showed that the static electrolyte system would be less complex and lighter in weight. For example, this latter system would yield, at the 4 hour charge-10 hour discharge cycle, 80 wh/lb energy density and an energy storage efficiency of 52%. Conceptual designs for nominal 10 KWH units are presented Author (TAB)

N67-11033# Eagle-Picher Co., Joplin, Mo. Couples Dept.

INVESTIGATIONS LEADING TO THE DESIGN AND DEVELOPMENT OF MAGNESIUM/MAGNESIUM PERCHLORATE BATTERIES Second Quarterly Report, Feb. 1–Apr. 30, 1966

James R. Sharpe Sep. 1966 50 p

(Contract DA-28-043-AMC-01763(E))

(Rept.-2; ECOM-01763-2; AD-638320) CFSTI: HC $2.00/MF $0.50

The report describes the significant accomplishments made on the research and development of magnesium/magnesium perchlorate batteries during the past quarter. A factorial experiment was performed to determine the effect of various cathodic blends (MnO_2). Data concerning voltage and performance characteristics of magnesium/manganese dioxide cells at high, medium and low temperatures is discussed. Data concerning a grid selection study and a cost analysis of materials is also presented Author (TAB)

N67-11091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

REPLACEMENT OF LEAD ACID STORAGE BATTERIES WITH ALKALINE ONES ON "ROCKET" TYPE SHIPS

N. Andreyev and V. Nalebin 7 Jun. 1966 9 p Transl. into ENGLISH from Rechn. Transp. (USSR), no. 7, 1964 p 42–43

(FTD-TT-65-1879; TT-66-62351; AD-639489) CFSTI: HC $1.00/MF $0.50

Modification of the electrical system of the Rocket (Rakata) class hydrofoil boats to accept alkaline cells in place of lead-acid storage batteries is described. TAB

N67-11095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DISCHARGE MONITORING MEDIA AND SYSTEM OF AUTOMATIC CHARGING OF ALKALI STORAGE BATTERIES

S. V. Malevanaya and Yu. I. Plotnikov 13 Jun. 1966 8 p Transl. into ENGLISH from Byull. Tekh.-Ekon. Informatsii (Moscow), no. 8, 1961 p 18–20

(FTD-TT-65-1896; TT-66-62223; AD-638870) CFSTI: HC $1.00/MF $0.50

The means for the monitoring of the discharging and charging of the storage batteries consists of a plug-in automatic device, the ShA-1, with a maximum current protection and a counter of ampere hours. The plug-in automatic device represents a two-chamber explosion-proof body in one of the chambers on which there is mounted a two-pole automatic unit, and in the other a

counter of electrical energy. As the counter, there is used a mercury indicator of the energy received by the battery (in ampere-hours) in the charging and the amount of it leaving the battery in the discharging. The system of the automatic charging of the battery (see drawing) consists of a relay of voltage and current and a blocking relay, the two of which in the assembly with the counter of electric energy, assure the automatic cutting in on charging and cutting out on finishing the discharging. TAB

N67-11102# Naval Weapons Lab., Dahlgren, Va.
DEVELOPMENT OF A RADIO INTERFERENCE GUARD (RIG) SQUIB
Norman W. Chlosta Aug. 1966 10 p
(NWL-TM-W-9/66; AD-637263) CFSTI: HC $1.00/MF $0.50

The rig squib is a combination attenuator and electroexplosive device which can be used as a replacement for squibs employed in various ordnance circuits. The attenuator portion of the squib is a low pass device whereby direct current (dc) and low frequency energy are permitted to enter the squib section relatively unaffected, while high frequency electromagnetic energy impinging upon the attenuator's input is deduced to a small level. As a result, ultilization of the rig squib could serve to preclude or greatly reduce the hazard of stray electromagnetic radiation initiating ordnance items. TAB

N67-11159# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHEMICAL CURRENT SOURCES
M. A. Dasoyan 18 Apr. 1966 428 p refs Transl. into ENGLISH of the book "Khimicheskiye Istochniki Toka" Moscow, Gosenergoizdat., 1961 350 p
(FTD-TT-66-7; TT-66-62235; AD-638888) CFSTI: HC $7.30/MF $2.00

The book gives basic information on the most important forms of chemical current sources. The variety of alkali and lead storage batteries and voltaic elements produced industrially is discussed, together with their electrical and service characteristics. Recommendations are made as to the choice of storage batteries for various operating conditions. The properties of the materials employed in the manufacture of chemical current sources are described. Safety techniques employed in working with storage batteries are considered. The book is designed for engineers and technicians concerned with the production or operation of chemical current sources. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N67-10013# Southwest Research Inst., San Antonio, Tex. Dept. of Physical and Biological Sciences.
A STUDY OF CALCIUM, PHOSPHORUS AND NITROGEN MOBILIZATION RESULTING FROM CONDITIONS OF INACTIVITY Final Report
Arthur L. Gross, Kenneth T. Roberson, Louis H. Krough, Jr., and John W. Miesse 30 Apr. 1966 104 p
(Contract AF 41(609)-2749)

CONTENTS:
1. A STUDY OF CALCIUM, PHOSPHORUS AND NITROGEN MOBILIZATION RESULTING FROM CONDITIONS OF INACTIVITY 97 p

APPENDIXES
2. COMPARATIVELY RAPID ANALYTICAL PROCEDURE FOR ANALYSIS OF CALCIUM, NITROGEN AND PHOSPHORUS IN BODY FLUIDS, FECES AND FOOD SAMPLES K. T. Roberson, A. L. Gross, L. Krough, and J. W. Miesse 3 p (See N67-10014 01-04)

3. CALCIUM, NITROGEN AND PHOSPHORUS MOBILIZATION RESULTING FROM INACTIVITY A. L. Gross, L. Krough, J. W. Miesse, and K. T. Roberson 3 p (See N67-10015 01-04)

N67-10014# Southwest Research Inst., San Antonio, Tex. Dept. of Physical and Biological Sciences.
COMPARATIVELY RAPID ANALYTICAL PROCEDURE FOR ANALYSIS OF CALCIUM, NITROGEN AND PHOSPHORUS IN BODY FLUIDS, FECES AND FOOD SAMPLES
Kenneth T. Roberson, Arthur L. Gross, Louis H. Krough, Jr., and John W. Miesse *In its* A Study of Calcium, Phosphorus and Nitrogen Mobilization Resulting from Conditions of Inactivity 30 Apr. 1966 3 p Presented at the Aerospace Med. Assoc. Meeting, Las Vegas, Nev., Apr. 1966 Submitted for Publication (See N67-10013 01-04)

Consideration is given to the daily calcium, nitrogen, and phosphorus balance of monkeys in various conditions of inactivity. The analytical method developed allowed the determination of these materials from a single perchloric acid digestion. It is noted that this procedure has proven to be very reliable and simple for the determination of large numbers of samples. A.G.O.

N67-10015# Southwest Research Inst., San Antonio, Tex. Dept. of Physical and Biological Sciences.
CALCIUM, NITROGEN AND PHOSPHORUS MOBILIZATION RESULTING FROM INACTIVITY
Kenneth T. Roberson, Arthur L. Gross, John W. Miesse, and Louis H. Krough, Jr. *In its* A Study of Calcium, Phosphorus and Nitrogen Mobilization Resulting from Conditions of Inactivity 30 Apr. 1966 3 p Presented at the Aerospace Med. Assoc. Meeting, Las Vegas, Nev., Apr. 1966 (See N67-10013 01-04)

Immobilization effects were studied by following calcium, phosphorus, and nitrogen balances in monkeys that were inactivated for periods as long as eight weeks. Methods of immobilization used were surgical denervation, tranquilization, and plaster casts. The results of the balance studies indicate that there is no apparent loss of calcium but that there is a marked increase in the urinary excretion of phosphorus with a concomitant decrease in fecal excretion of phosphorus resulting in no net loss. Animals immobilized by means of plaster casts and denervation exhibited a marked negative nitrogen balance. A.G.O.

N67-10017# Oxford Univ. (England). Dept. of the Regius Professor of Medicine.
PULSATILE PRESSURE-FLOW RELATIONSHIPS IN THE PULMONARY ARTERIAL SYSTEM OF MAN
G. de J. Lee Jan. 1964 53 p refs
(Grant AF-EOAR-62-21)
(AD-635991) CFSTI: HC $3.00/MF $0.50

CONTENTS:
1. THE EFFECT OF PULSATILE CAPILLARY BLOODFLOW UPON GAS EXCHANGE WITHIN THE LUNGS OF MAN A. R. Bosman, G. de J. Lee, and R. Marshall 21 p refs (See N67-10018 01-04)
2. THE EFFECTS OF CARDIAC ACTION UPON LUNG GAS VOLUME A. R. Bosman and G. de J. Lee 20 p refs (See N67-10019 01-04)

N67-10018# Oxford Univ. (England). Dept. of the Regius Professor of Medicine.
THE EFFECT OF PULSATILE CAPILLARY BLOODFLOW UPON GAS EXCHANGE WITHIN THE LUNGS OF MAN

A. R. Bosman, G. de J. Lee, and R. Marshall *In its* Pulsatile Pressure–Flow Relationships in the Pulmonary Arterial System of Man Jan. 1964 21 p refs (See N67-10018 01-04) CFSTI: HC $3.00/MF $0.50

A study to determine the effects of pulsatile pulmonary capillary blood flow upon alveolar-capillary gas exchange in man is described. Oxygen and carbon dioxide exchange within the lungs was measured individually and instantaneously throughout the cardiac cycle using the whole body plethysmograph. Special gas mixtures were breathed in order to obtain O_2 and CO_2 tensions at mixed venous levels in turn within the lungs to measure the alveolar-capillary exchange of each gas individually, and to compare these with the pulmonary capillary blood flow rate measured by an N_2O method. Oxygen uptake within the lungs was linearly related to the pulmonary capillary blood flow rate. Carbon dioxide elimination occurred at two rates dependent upon the pulmonary capillary blood flow rate and upon the rate of discharge of CO_2 stored within the lung tissue itself. C.T.C.

N67-10019# Oxford Univ. (England). Dept. of the Regius Professor of Medicine.

THE EFFECTS OF CARDIAC ACTION UPON LUNG GAS VOLUME

A. R. Bosman and G. de J. Lee *In its* Pulsatile Pressure-flow Relationships in the Pulmonary Arterial System of Man Jan. 1964 20 p refs (See N67-10018 01-04) CFSTI: HC $3.00/MF $0.50

An examination was made of the causes of variations which take place in the gas volume of the lungs during each cardiac contraction as a result of events within the thorax, other than those to alveolar-capillary gas exchange. Also examined were various cardiovascular conditions which might be expected to produce alterations in the normal relationships of arterial and venous blood flow with the thorax in an attempt to analyze the mechanisms involved. It was found that during systole, aortic outflow from the thorax exceeds venous inflow. This leads to a transient fall in thoracic blood volume resulting in a rarefaction of lung gases accompanied by air entry at the mouth, and a transient increase in apparent body volume. During diastole, venous inflow to the thorax exceeds arterial outflow. As a result gas flow reverses in the airways and the total body volume shows an apparent shrinkage. C.T.C.

N67-10023# Central Lab. for Radiological Protection, Warsaw (Poland).

DOSIMETRY OF ENVIRONMENTAL GAMMA-RADIATION IN POLAND BY MEANS OF GAMMA-RAY SPECTRA IN THE FIELD

J. Pensko, T. Olkowska, and M. Wilk 1966 30 p refs Submitted for Publication

(CLOR-48/D) CFSTI: HC $2.00/MF $0.50

The direct measurements of the gamma-ray background exposure rate was carried out up to date by means of ionization chambers or Geiger–Müller counters. These methods are very sensitive and accurate but they do not allow to separate natural gamma background from the fallout components. The exposure rate caused by fallout was usually determined by the concentration measurements of the more important fission products in the soil or plants. In this paper some of our experiences with the spectrometric method are presented which makes possible direct evaluation of dose-rates from the main gamma emitters of background radiation in Poland. Some results obtained were compared with the exposure rate computation after the estimation of potassium, uranium and thorium concentration in the soil samples. The 1962–1965 results of environmental dose rate measurements of more important gamma emitters (natural and fission products) for 20 different places in Poland were presented and discussed. Author

N67-10032# Strasbourg Univ. (France).

EXPERIMENTAL STUDY OF THE TREATMENT OF RADIATION INJURIES BY PADUTIN (KALLICREINE) [ETUDE EXPERIMENTALE DU TRAITEMENT DES RADIO-LESIONS PAR LA PADUTINE-DEPOT (KALLICREINE)] Activity Report, 1 Apr.–1 Oct. 1965

P. Mandel, J. M. Mantz, M. Delemon, P. Michaelidis, J. Rodesch (EURATOM) et al Brussels, EURATOM, Jul. 1966 23 p refs In FRENCH; ENGLISH summary

(Contract EURATOM-054-63-10 BIOF)

(EUR-2477.F, vol. III) CFSTI: HC $1.00/MF $0.50

Further experiments carried out on the rat show that following a treatment with kallicreine the cicatrization period for cutaneous radiolesions is considerably lower in the treated animals than in the controls (60,000 r.). The same phenomenon has been demonstrated with the guinea-pig and the rabbit (80,000 r). Experiments are at present in progress to corroborate these findings. Study of the optimum treatment conditions led to the following therapeutic doses: 5 BU for the rat, 10 BU for the guinea-pig and 20 BU for the rabbit. The best time to begin the treatment is the clear ulceration stage, i.e. 3rd week after irradiation for the rat and the guinea-pig, and 4th or 5th week for the rabbit. Kallicreine administered as a preventive injection after whole-body irradiation (800 r) appears to have no effect on the survival rate of the animals. However, quantitative determinations of nucleic acids and a cytological study of the marrow of a bone system show a protective effect which is particularly marked at about the 7th day after irradiation. From the recovery angle (treatment after whole-body irradiation at 800 r) it is observed that the life of the animals is considerably prolonged, particularly by the repeated intraperitoneal administration of kallicreine. Quantitative determinations of bone-marrow nucleic acids permit the inference of a regeneration of the medullary cells which is especially active from the 4th day after irradiation. Author

N67-10033# Institute for Perception RVO–TNO, Soesterberg (Netherlands).

EXPERIMENTS ON TONE PERCEPTION

R. Plomp 1966 76 p refs

(TDCK-45965) CFSTI: HC $3.00/MF $0.75

The manner in which simultaneously sounding tones are perceived and discriminated by the ear suggests that both frequency analysis and periodicity analysis are involved. Experiments are described which were performed to determine the role of both types of analysis in audition and the way in which they are related. The limit of the ear's ability to discriminate the harmonics of a complex tone is treated, and the appearance of combination tones is studied. The interference of simple tones with a small frequency difference is investigated in relation to the origin of tonal consonance. The phenomenon that two simple tones may also interfere for frequency differences much larger than critical bandwidth is discussed, and the idea that the pitch of complex tones is based on the frequency of the fundamental or on the periodicity of the sound as a whole is studied. The experimental results are discussed in the light of the physiological data, and the conclusions drawn are examined. H.S.W.

N67-10141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE JOURNAL OF HIGHEST NERVOUS ACTIVITY

Apr. 1966 76 p refs Transl. into ENGLISH from Zh. Vysshei Nervnoi Deyatel'nosti (Moscow), v. 12, Issue I, 1962 p 7–36, 128–134

(FTD-MT-65-308; AD-637376) CFSTI: HC $3.00/MF $0.75

CONTENTS:

1. THE REFLEX OF PURPOSE AS AN OBJECT OF PHYSIOLOGICAL ANALYSIS P. K. Anokhin p 1–27 refs (See N67-10142 01-04)

2. CONDITIONED REFLEX CHANGES OF BREATHING AGAINST A BACKGROUND OF SLEEP INHIBITION D. A. Biryukov, T. P. Shlyafer, and M. I. Yakovlev p 29–42 refs (See N67-10143 01-04)

3. ON THE FORMATION OF CONDITIONED REFLEXES OF HIGHER ORDERS IN ADULTS G. A. Shichko p 43–54 refs (See N67-10144 01-04)

4. CHANGE OF THE RESPIRATORY COMPONENT OF THE MOTOR DEFENSIVE CONDITIONAL REACTION DURING DIFFERENT FUNCTIONAL STATES OF THE RESPIRATORY CENTER I. I. Tokarenko p 55–67 refs (See N67-10145 01-04)

N67-10142# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE REFLEX OF PURPOSE AS AN OBJECT OF PHYSIOLOGICAL ANALYSIS

P. K. Anokhin *In its* The J. of Highest Nervous Activity 22 Apr. 1966 p 1–27 refs (See N67-10141 01-04) CFSTI: HC $3.00/MF $0.75

A literature review is presented on the reflex of purpose, the basic form of individual vital energy. Examples are mentioned of the great role that the nerve complexes of purpose play (e.g., the anthropomorphic apes constructing a pyramid of boxes to obtain fruit). It is concluded that the problem of reflex of purpose must be studied on the basis of modern achievements of higher nervous activity, and the general physiology of the central nervous system. The mechanism of attracting in concrete behavorial acts (e.g., salivation of dogs before feeding) is briefly covered. Emphasis is placed on further investigation of the universal activating force at the highest levels of the nervous system. R.Ll.

N67-10143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONDITIONED REFLEX CHANGES OF BREATHING AGAINST A BACKGROUND OF SLEEP INHIBITION

D. A. Biryukov, T. P. Shlyafer, and M. I. Yakovlev *In its* J. of Highest Nervous Activity 22 Apr. 1966 p 29–42 refs (See N67-10141 01-04) CFSTI: HC $3.00/MF $0.75

Studies of conditioned reflex activity in newborn children and animals are reviewed in connection with respiratory and heart reflexes against a background of sleep disturbances. Conclusions reported are: (1) Conditioned reflex changes in children's breathing and heart activity in the first months of life, and in kittens in the early periods of postnatal ontogenesis against a background of shallow sleep inhibition, are easily formed and do not differ essentially from conditioned reflexes developed in a state of wakefulness. (2) These conditioned reflex changes in children older than one year do not develop. The already secured conditioned reflex vegetative changes in these children are characterized, against a background of sleep inhibition, by their inconstancy of appearance. (3) Deep sleep prevents the production as well as the reproduction of conditioned reflex changes in breathing and heart activity. R.Ll.

N67-10144# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE FORMATION OF CONDITIONED REFLEXES OF HIGHER ORDERS IN ADULTS

G. A. Shichko *In its* J. of Highest Nervous Activity 22 Apr. 1966 p 43–54 refs (See N67-10141 01-04) CFSTI: HC $3.00/MF $0.75

The method and experimental results of the formation of nervous system conditioned reflexes in higher orders of adult humans are discussed. It was found that in a healthy adult, the formation of conditioned reflexes from the 2nd to the 20th orders by a conventional method, and conditioned reflexes from the 2nd to the 5th orders through the second signal system is possible; this testifies to the extraordinarily high efficiency of the cortex of the large hemispheres of man. Experimental results show that conditioned reactions to a stimulus, or signal, are usually lower in quantity than reactions to a conditioned reinforcement. It is considered that the formation mechanism of reflexes of higher orders does not differ essentially from the formation mechanism of the conditioned reflexes of the first order; the basic distiction is in the method of excitation of the cortex representation of an unconditioned reflex. R.Ll.

N67-10145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CHANGE OF THE RESPIRATORY COMPONENT OF THE MOTOR DEFENSIVE CONDITIONAL REACTION DURING DIFFERENT FUNCTIONAL STATES OF THE RESPIRATORY CENTER

I. I. Tokarenko *In its* The J. of Highest Nervous Activity 22 Apr. 1966 p 55–67 refs (See N67-10141 01-04) CFSTI: HC $3.00/MF $0.75

Respiratory change of a motor defensive conditoned reaction in answer to reinforced and unreinforced conditioned stimuli during various functional states of the respiratory center is discussed. Results of experiments on dogs led to the following generalizations: (1) Respiratory characteristics of a motor defensive conditioned reaction depend on the initial functional state of the respiratory center; a strengthening as well as a suppression of respiration may result. (2) Positive conditioned stimuli in most animals during initial weak breathing cause an increase of the amplitude and frequency of respiratory movements, while during deep breathing, they hinder respiration. (3) Protective and differential inhibitions appear primarily not in the cortical cells of the cerebral end of the analyzer, perceiving the stimulation, but apparently somewhere on the subsequent instances of the conditioned reflex arc. R.Ll.

N67-10156# Joint Publications Research Service, Washington, D. C.

SOME ASPECTS OF INFORMATION THEORY AND ITS RELATION TO LIVING ORGANISMS

16 Nov. 1965 42 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 9, 1965
(JPRS-32876; TT-65-33454) CFSTI: $2.00

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3. CAN LIVING MATTER BE CREATED ARTIFICIALLY K. S. Trincher p 26–36 refs (See N67-10159 01-04)

N67-10158# Joint Publications Research Service, Washington, D. C.

LIVING ORGANISMS AND THE ANTI-ENTROPY EFFECT OF INFORMATION

A. I. Bykhovskiy *In its* Some Aspects of Inform. Theory and its Relation to Living Organisms 16 Nov. 1965 p 17–25 refs (See N67-10156 01-04) CFSTI: $2.00

The application of the physical theory of information to the problems of existence and evolution of living systems is presented. The unelaborated state of certain propositions of this theory is apparent from the literature review. Consideration is given to the question of the applicability of the second law of thermodynamics to living organisms and ways to solve questions regarding the diminution of entropy from generation to generation in the process of the evolutionary development and multiplication of living systems. R.Ll.

N67-10159# Joint Publications Research Service, Washington, D. C.

CAN LIVING MATTER BE CREATED ARTIFICIALLY

K. S. Trincher *In its* Some Aspects of Inform. Theory and its Relation to Living Organisms 16 Nov. 1965 p 26–36 refs (See N67-10156 01-04) CFSTI: $2.00

The problem of artificial creation of living matter is reviewed and evaluated. Mentioned are the cybernetic devices especially created to perform biologic functions and intellectual activity in exactly the same way as a living organism. The anti-cybernetic viewpoint concedes that those functions of the living organism that lend themselves to imitation by cybernetic devices, to any desired degree of precision, represent working processes which do not contradict the second law of thermodynamics. Following an analytical examination of the second law of thermodynamics, it is suggested that the presence of the negentropic state of the intracellular water (i.e., the thermally unstable state of the structure of living matter) contradicts this law. Consequently, it is stated, biologic metabolism (the specific function of the living organism) represents a peculiar working process characteristic only of living matter and cannot be imitated. R.Li.

N67-10160# National Aerospace Lab., Tokyo (Japan).
A PSYCHOLOGICAL STUDY ON THE MENTAL STRESS OF PILOTS (I). PULSE AND RESPIRATORY RATE DURING FLIGHT
Noriko Miyoshi, Moriyuki Momona, and Masanori Okabe 1966 15 p refs *In* JAPANESE; ENGLISH summary
(NAL-TR-105) CFSTI: HC $1.00/MF $0.50

The usefulness of measuring changes in pulse and respiratory rates as the indices to monitoring the mental stress of pilots in flight is reported. Continuous measurements during one hour flight were carried out with nine experienced pilot subjects. The flight profile included 14 different maneuvers in a twin-engine aircraft. Recordings were made with both the main pilot and the co-pilot flight situation. As the control data, a rating scale for their mental stress level when performing the above 14 tasks was prepared. Author

N67-10197*# National Aeronautics and Space Administration, Washington, D. C.
STUDY OF THE FUNDAMENTAL VIBRATION OF THE ARTERIAL PULSE WAVE
Jiro Sato Oct. 1965 29 p refs Transl. into ENGLISH from J. Phys. Soc. Japan (Tokyo), v. 23, no. 3, 1961 p 133–146
(NASA-TT-F-9572) CFSTI: HC $2.00/MF $0.50 CSCL 06P

The cause of the fundamental vibration of the arterial pulse wave was studied on the arterial pressure pulse of aorta and femoral artery in dogs and rabbits. It was observed that the wavelength of the fundamental vibration changes with the pattern of ejection and the dynamical state of the vascular system. It was concluded that this vibration mainly originates from the ejection of blood from left ventricle to arterial system. Author

N67-10217*# National Aeronautics and Space Administration, Washington, D. C.
UTILIZATION OF FRUCTOSE BY HYDROGENOMONAS H 16 (PART I) [VERWERTUNG VON FRUCTOSE DURCH HYDROGENOMONAS H 16 (II)]
G. Gottschalk, U. Eberhardt, and H. G. Schlegel Oct. 1966 23 p refs Transl. into ENGLISH from Arch. Mikrobiol. (Berlin), v. 48, 1964 p 95–108
(NASA-TT-F-10309) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Experiments on the utilization of fructose by chemolithotrophically grown cells of Hydrogenomonas strain H 16 showed oxidation of this sugar after a lag of 20 min. The fructose is metabolized over the Entner–Doudoroff pathway. During adaptation to fructose, the content of phosphoglucose isomerase, glucose-6-phosphate dehydrogenase, and enzymes characteristic for the Entner–Doudoroff pathway increases in the cells. During the change from chemolithotrophic to organotrophic growth, with fructose as substrate, the activity of ribulosediphosphate carboxylase is reduced by 75% within 2 hrs, but decreases only slowly during fructose passages. Thus, fructose-grown Hydrogenomonas H 16 is able to fix carbon dioxide over the Calvin cycle. Author

N67-10218*# National Aeronautics and Space Administration, Washington, D. C.
A SUBMERSION METHOD FOR THE CULTURE OF HYDROGEN-OXIDIZING BACTERIA: GROWTH-PHYSIOLOGICAL INVESTIGATIONS [EIN SUBMERSVERFAHREN ZUR KULTUR WASSERSTOFF-OXYDIERENDER BAKTERIEN: WACHSTUMSPHYSIOLO GISCHE UNTERSUCHUNGEN]
H. G. Schlegel, H. Kaltwasser, and G. Gottschalk Oct. 1966 21 p refs Transl. into ENGLISH from Arch. Mikrobiol. (Berlin), v. 38, 1961 p 209–222
(NASA-TT-F-10310) CFSTI: HC $1.00/MF $0.50 CSCL 06M

A method for submersion culture of knallgas bacteria is described, in which the nutrient solution is agitated magnetically under a mixture of H_2, O_2, and CO_2 and the high O_2-sensitivity of the cells is allowed for by "gradient gassing". The facultative chemolithotrophic Hydrogenomonas strain 20 was bacteriologically characterized and growth-physiologically investigated. During the logarithmic phase, the generation time was 2-1/6 hrs, and the apparent doubling time was 3-1/5 hrs (28°C). Author

N67-10223*# National Aeronautics and Space Administration, Washington, D. C.
THE PARTICIPATION OF PROTEIN PRECURSORS IN THE MECHANISM OF THE SYNTHESIS OF SPECIFIC PROTEINS [OB UCHASTII BELKOV-PREDSHESTVENNIKOV V MEKHANIZME SINTEZA SPETSIFICHESKIKH BELKOV]
I. I. Ivanov, V. V. Rudakov, I. A. Baryshnikov, and A. G. Taranenko Oct. 1966 4 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 168, no. 4, 1966 p 942–943
(NASA-TT-F-10348) CFSTI: HC $2.00/MF $0.50 CSCL 06A

Experiments were conducted on intact and isolated lactating mammary glands of goats. Amino acids and blood plasma proteins were washed off isolated mammary glands. It was found that isolated glands maintained their capacity to synthesize lactic proteins under these conditions. It was concluded that these proteins emanated from amino acids present in tissue proteins of the mammary gland. Author

N67-10224*# National Aeronautics and Space Administration, Washington, D. C.
ENDURANCE OF EXTERNAL ACCELERATION INCREASED AS A RESULT OF EXPOSURE TO IONIZING RADIATION [PERENOSIMOST EKSTREMAL'NOGO USKORENIYA POSLE VOZDEYSTVIYA IONIZIRUYUSHCHEY RADIATSII]
B. I. Davydov Oct. 1966 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSR (Moscow), v. 168, no. 3, 1966 p 691–693
(NASA-TT-F-10349) CFSTI: HC $1.00/MF $0.50 CSCL 06R

White mice were used to investigate post-radiation resistance (doses ranged from 100–4000 R) to 3 min back-chest accelerations of 42–44 G. In 1–8 days after irradiation, experimental animals were more resistant to accelerations than control animals and that the degree of post-radiation resistance depended on radiation dose. It was speculated that shifts in blood clotting function and cell membrane permeability during certain stages of radiation sickness might improve hemodynamic conditions for exposure to critical accelerations. Author

N67-10228*# National Aeronautics and Space Administration, Washington, D. C.
THE STATE OF HEARING IN RADIATION SICKNESS [SOSTOYANIYE SLUKHA PRI LUCHEVOY BOLEZNI]

M. Ya. Kozlov Oct. 1966 8 p refs Transl. into ENGLISH from Med. Radiol. (Moscow), v. 3, no. 4, Jul.–Aug. 1958 p 64–69
(NASA-TT-F-10352) CFSTI: HC $1.00/MF $0.50 CSCL 06R

The state of the peripheral ending of the auditory analyzer of the internal ear was investigated during radiation sickness caused by a sublethal dose of X-ray radiation (350 R). Experiments were performed on guinea pigs. An objective method of recording the cochlear currents was used. It was established that when guinea pigs are irradiated with X-rays with a dose of 350 R an acute radiation sickness of the average degree is produced with a mortality of 50 percent. During the peak of the radiation sickness there is a decrease in the auricular reflex and a decrease in the bioelectric potentials of the cochlea at all frequencies by 3.9 to 9.1 decibels. Author

N67-10227*# National Aeronautics and Space Administration, Washington, D. C.
OLFACTORY DISTURBANCES IN MAN FOLLOWING EXPOSURE TO RADIATION [OBONYATEL'NYYE NARUSHENIYA U LYUDEY PRI LUCHEVOM VOZDEYSTVII]
L. B. Koznova Oct. 1966 8 p refs Transl. into ENGLISH from Med. Radiol. (Moscow), v. 2, 1957 p 26–30
(NASA-TT-F-10353) CFSTI: HC $1.00/MF $0.50 CSCL 06R

Disruptions in olfaction have been studied based on the observation of the general reaction of the human organism subjected to X-ray radiation in connection with mammary gland tumors. Changes in the olfactory analyzer were recorded by means of an olfactometer. Additional experiments were conducted with patients who were given caffeine to accentuate the sensitivity of their olfactory analyzer. The results of the investigations correlated with the complaints of patients subjected to radiation who experienced olfactory disturbances have convinced the author that such disturbances involve changes in the central nervous system and do not represent true hyperosmia since the subjective accentuation of olfaction during radiation treatment is not accompanied by a decrease in the thresholds of olfaction. Author

N67-10289# Pittsburgh Univ., Pa.
EFFECTS OF COLD STRESS ON CELLULAR STRUCTURE AND FUNCTION Final Report, Nov. 1963–Nov. 1965
Ralph Buchsbaum, Monte Buchsbaum, and Thomas Linsenmayer Wright-Patterson AFB, Ohio, AMRL, May 1966 16 p ref
(Contract AF 33(615)-1076)
(AMRL-TR-66-30; AD-638327) CFSTI: HC $1.00/MF $0.50

The purpose of this investigation was to ascertain more precisely the limits of tolerance of cells in vitro to cold, as a basis for investigations on the cellular mechanisms affected. Mouse kidney cells were maintained in a perfusion chamber arranged for cooling and warming at various rates. Normal tissue culture media were used. Nearly all cells exposed to −0.3°C for 10 minutes, then warmed to 37°C, lived. Nearly all cells exposed to −1°C or lower for 10 minutes, and warmed to 37°C, died. The critical lethal cold shock seems to produce little obvious change in cells, but mitochondrial breaks and swelling are obvious in electron micrographs. Also, nuclear ground substance appeared more granular than normal. One hypothesis was that microcrystallization probably occurs in certain organelles, particularly the mitochondria because these organelles are in constant motion. Similar results were obtained in experiments with human neutrophiles. Author (TAB)

N67-10295# Solano Labs., Berkeley, Calif.
BIOCHEMICAL PROPERTIES OF INNER EAR FLUIDS: METHODS OF MICROCHEMISTRY AND FLUID WITHDRAWAL Final Report, May 1961–Apr. 1964
Marion T. Ulrich, J. R. Mundie, Jr., (AMRL), and Sheldon Margen Wright-Patterson AFB, Ohio, AMRL, Mar. 1966 32 p refs Prepared jointly with AMRL
(Contracts AF 33(616)-8083; AF 33(657)-9373)
(AMRL-TR-65-177; AD-638387) CFSTI: HC $2.00/MF $0.50

Biochemical assay of fluids of the inner ear is pertinent to understanding mechanisms of electrical current generation by living tissue and could elucidate the physiology of acoustic trauma. Quantity of fluid available is limited to a few microliters per sample. A method is presented for collecting fluids from the cochlea while simultaneously measuring DC electrical potentials to identify endolymph. Ultra-micro biochemical and enzyme analyses were developed with adaptations in equipment and procedure. Techniques for assay of sodium, potassium, chloride, sugar, protein, adenosine triphosphate, hexokinase, phosphocreatine, diphosphopyridine nucleotide, lactic dehydrogenase, malic dehydrogenase and adenosine diphosphate in sample volumes of 1-2 microliters are outlined. Data on sodium, potassium, chloride and protein content of endolymph and perilymph agreed with results obtained by other investigators. Sugar averaged 117 mg/100 ml in perilymph and 183 mg/100 ml in endolymph. The enzyme compounds, investigated only in perilymph, were not detectable by these methods on 1 microliter samples Author (TAB)

N67-10297# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
BIOLOGICAL EFFECTS OF BLAST AND SHOCK Technical Progress Report
Donald R. Richmond and Clayton S. White Apr. 1966 58 p refs
(Contract DA-49-146-XZ-055; AT(29-1)-1242)
(DASA-1777; AD-638342) CFSTI: HC $3.00/MF $0.50

The scope of blast and shock biology was set forth as covering effects resulting from overpressure (primary), flying debris (secondary), and displacement (tertiary). Procedures employed in the laboratory for simulating the blast wave forms as they varied within structures on nuclear tests were described. For each effect, a selected summary of current information relating the physical parameters to given levels of biological response was presented. From this, the blast and shock hazards estimated for personnel, as a function of range and yield, were illustrated in the form of curves. The range-yield-effects relationship for the biological criteria was discussed in terms of free-field and other exposure situations. They were compared with similar range-effects data for thermal and nuclear radiation Author (TAB)

N67-10308# Cedars of Lebanon Hospital, Los Angeles, Calif. Polymer Div.
THEORETICAL STUDY OF THE FLUID TRANSPORT AND THE HYDRATION OF THE CORNEA
H. Yasuda [1963] 43 p refs Submitted for Publication
(Contract Nonr-3662(01); Grant NIH NB-4281)
(AD-624039) CFSTI: HC $2.00/MF $0.50

An attempt is made to analyze available data in the transport, the swelling and the imbibition property of the corneal stroma from the basis of the barrier properties of a substance and of thermodynamics of the processes. TAB

N67-10310# Gottingen Univ. (West Germany). Inst. for Plant Physiology.
ON THE ROLE OF PLASTOCYANIN IN PHOTOSYNTHESIS AND A NEW INHIBITOR OF FERREDOXIN DEPENDENT REACTIONS Annual Summary Report
A. Trebst 1 May 1966 17 p refs
(Contract AF 61(052)-718)
(ASR-3; AFCRL-66-606; AD-637991) CFSTI: HC $1.00/MF $0.50

By digitonin treatment of chloroplasts, followed by differential ultracentrifugation, stable particles are obtained which reduce NADP in illumination only if plastocyanin is added. The system requires ferredoxin, ferredoxin-NADP-reductase, an electron donor system and is saturated by 0.002 micromoles plastocyanin. KCN and salicylaldoxime inhibit the system. An effective inhibitor of ferredoxin dependent reactions was found in disalicylidene-propanediamine

(DSPD) as shown by its behavior in photosynthetic reactions of isolated chloroplasts. DSPD inhibits photosynthesis and light-dependent glucose uptake, but not the Hill reaction with quinone, by intact Chlorella cells. This strongly supports the view that ferredoxin is the natural cofactor of cyclic photophosphorylation in vivo. Unexpectedly, however, DSPD does not inhibit photosynthetic nitrite reduction in Chlorella, which is also assumed to require ferredoxin. Author (TAB)

N67-10322# New York Medical Coll., N. Y.
REHARDENING OF SOFTENED ENAMEL SURFACES Final Report, Jul. 1, 1964–May 31, 1966
Ward Pigman 1 Oct. 1966 26 p refs Submitted for Publication
(Contract Nonr-4628(00))
(AD-638357) CFSTI: HC $2.00/MF $0.50

The calcification ability of body fluids was measured by the techniques developed for studying remineralization of softened tooth surfaces. Human submaxillary, parotid and whole salivas had marked calcifying properties and individual differences were evident. Human blood serums had considerably less calcification ability and were similar to the extracellular fluid synovial fluid. Some of these serums and synovial fluids had no ability. The method offers a new and unique approach to the direct measurement of the calcifying powers of body fluids and of correlating these properties with pathological conditions affecting calcification processes. The method was used for both in vivo and in vitro work. For the latter, small slabs of softened tooth enamel were inserted subdermally in guinea pigs. After eight days, the slabs were removed and the hardness determined. Extensive rehardening occurred. This variation of the method should be useful for the vitro controlled experiments with animals, and possibly even humans Author (TAB)

N67-10343# Naval Medical Research Inst., Bethesda, Md.
A TECHNIQUE FOR AUTOMATED AUDITORY PRESENTATION AND SCORING OF MULTIPLE-CHOICE TESTS
Seward Smith Jul. 1966 16 p
(Rept.-16; AD-638227) CFSTI: HC $1.00/MF $0.50

The purpose of this paper is to provide information about a technique which permits auditory presentation and automatic factor scoring of pre-recorded multiple choice test items. The technique is described in detail. Advantages and applications are indicated. (Author)TAB

N67-10378# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
PROCEDURE TO ASSESS ENERGY EXPENDED DURING A SHORT-PERIOD TASK Technical Report, May–Aug. 1964
Dieter E. Walk and Edwin H. Sasaki Dec. 1965 20 p refs
(AMRL-TR-65-205; AD-637692) CFSTI: HC $1.00/MF $0.50

A procedure was developed to measure the energy expended in a rowing task completed during a 12-second zero-G parabola. The technique was based on completed expired air samples. The subject's expired air was collected under three conditions: (1) 30 seconds of rest, (2) 12 seconds of rowing, and (3) 15 seconds of recovery. The conditions were repeated 10 times, and the subject's expired air was cumulated separately in three bags to obtain, in essence, a 5-minute collection for rest, a 2-minute collection for work, and a 2-1/2 minute collection for recovery. This procedure was replicated in four environments: laboratory, aircraft 1G level flights, aircraft 2G-1G-2G bank maneuvers, and aircraft 2G-0G-2G parabolic maneuvers. The results showed that the body reacted to a change in physical activity and returned to a state of equilibrium much more quickly than previously reported in the literature. The volumes of expired air, oxygen, and carbon dioxide in each condition (rest, work, and recovery) were similar in the four environments, but the specific effects, if any, of the differential gravity levels were negligible and unsystematic. Author (TAB)

N67-10417# Chicago Univ., Ill. Toxicity Lab.
STUDIES ON SPLEEN OXYGEN TENSION AND RADIOPROTECTION IN MICE WITH HYPOXIA, SEROTONIN AND P-AMINOPROPIOPHENONE Formal Report, Dec. 1, 1965–May 31, 1966
Andrew T. Hasegawa and H. D. Landahl Jun. 1966 24 p refs
(Contract AF 41(609)-2977)
(AD-638372) CFSTI: HC $1.00/MF $0.50

Polarographic measurements of the oxygen tension in the spleen and vena cava, as well as radioprotection studies, were carried out in mice forced to breathe an atmosphere of low oxygen (10%, 7%, and 4.6%) or injected with serotonic (90 mg./kg.) or p-aminopropiophenone (30 mg./kg.). The spleen oxygen levels at 10%, 7%, and 4.6% oxygen were 0.36, 0.27, and 0.10 of normal respectively. The dose reduction factors at the corresponding levels were 1.24, 1.73, and 1.96. Serotonin reduced the oxygen tension to 0.53 of normal and a dose reduction factor of 1.77 was obtained. A dose reduction factor of 1.74 was obtained in PAPP-treated mice irradiated 15 minutes after injection and when the oxygen tension level was 0.35 of normal. A dose reduction factor of 2.92 was obtained in serotonin-treated mice irradiated while breathing an atmosphere of 4.6% oxygen. The greatest decline in oxygen tension occurred in these mice when the level in the vena cava declined to 0.06 of normal. If one plots the relative effectiveness of the radiation (y = 1/DRF) versus the relative oxygen tension (x) of the spleen and vena cava for each of the experimental situations, there exists an approximate linear relationship. The results indicate that there is a small amount of protection by both serotonin and PAPP which is independent of hypoxia. This relationship is given as $Fiy = 0.42 + 0.60\,x$, in which the values of Fi are 1.4, 1.2, and 1.12, where i refers respectively to serotonin, sodium nitrite, and PAPP. Author (TAB)

N67-10469# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
THE FIRE HAZARDS TO MAN IN COMPRESSED-AIR ENVIRONMENTS
J. Ernsting, A. W. Cresswell and D. M. Denison London, Flying Personnel Res. Comm., Jan. 1966 6 p ref
(FPRC/1249) CFSTI: HC $1.00/MF $0.50

Previous work showed a greatly increased fire hazard to man when the ambient partial pressure of oxygen exceeds 0.4 atm. This increase was uninfluenced by the presence of up to 0.6 atm of nitrogen. Present experiments, in compressed air at 2.0 to 5.0 atm, show a significant damping effect of concomitant nitrogen, that prevents the flash-propagation seen previously. Author

N67-10471# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
THE FIRE RISKS TO MAN OF OXYGEN RICH GAS ENVIRONMENTS
D. Denison, J. Ernsting, and A. W. Cresswell London, Flying Personnel Res. Comm., Jul. 1965 12 p refs
(FPRC/Memo-223) CFSTI: HC $1.00/MF $0.50

Igniting clothing fires were studied in gas environments with oxygen partial pressures ranging from 0.2 to 1.0 atmospheres. The effects of variations in the type, fit and proofing of clothing and in the detailed use of the water spray extinguishing system were noted. These experiments strongly suggest that: (a) The risks of igniting a man are greatly increased in these environments. (b) Fires in oxygen-rich environments are of a fundamentally different character to those in air. (c) Igniting a clothed man in these environments may lead to fatal damage within 5 to 20 sec of onset. (d) A dense local water spray can control this fire. (e) The damage to the man is critically dependent upon the type, fit and proofing of his clothing and on the timing density and distribution of the extinguishing water sprays. Author

N67-10473# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
THE EFFECTS OF INVERSION UPON LUNG VOLUME AND VENTILATION
D. Denison London, Flying Personnel Res. Comm., Jan. 1965 12 p refs
(FPRC/Memo-222) CFSTI: HC $1.00/MF $0.50

Lung volumes and lung ventilation have been measured in the upright and in an inverted position by a combination of spirometry and a helium dilution technique. Consistent changes in lung volume were seen–comprising mean changes of a 14% decrease in total lung capacity and vital capacity, and a 6% increase in inspiratory capacity, a 24% decrease in functional residual capacity, a 38% decrease in expiratory reserve volume and a 12% fall in residual volume. Changes in lung ventilation were variable but showed a mean increase of 13% in respiratory rate, tidal volume, minute volume and calculated alveolar ventilation. The relevance of these findings to the problem of weightlessness is discussed. A method of calibrating the helium katharometer is described that is of more general applicability. Author

N67-10483# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.
A COLLAR AND CHAIN PROCEDURE FOR HANDLING AND SEATING MACACA MULATTA
Charles M. Hurst Aug. 1966 19 p refs
(ARL-TR-66-14; AD-638488) CFSTI: HC $1.00/MF $0.50

A collar and chain procedure for transporting Macaca mulatta from living cages to pillory neck plate type restraint chairs, is described. The relative merits of this procedure are discussed in comparison with standard handling techniques. The application of this procedure was demonstrated with 14 Macaca mulatta (7 males and 7 females) ranging in weight from 3.4 to 6.6 kilograms Author (TAB)

N67-10556# Radiobiological Inst. TNO, Rijswijk (Netherlands).
INVESTIGATIONS ON BONE MARROW TRANSPLANTATION IN IRRADIATED ANIMALS AND THE PRODUCTION OF SPECIFIC PATHOGEN FREE ANIMALS AND THEIR APPLICATION IN RADIOBIOLOGY, 1 DECEMBER 1962–31 DECEMBER 1965
Brussels, EURATOM, Sep. 1966 41 p refs
(Contract EURATOM-029-63-1 BIAN)
(EUR-3122.e) CFSTI: HC $2.00/MF $0.50

The program on bone marrow transplantation has consisted of fundamental studies which were performed with mice and rats, as well as preclinical experiments with monkeys. Among the most notable results are the successful homologous bone marrow transplantation in irradiated rats, which is partly to be ascribed to the use of specific pathogen free animals; the successful suppression of the acute secondary disease in monkeys following transplantation of homologous marrow; the development of an effective method of preservation of monkey bone marrow at low temperatures; the identification of leukocyte antigen groups probably representing tissue transplantation antigens in Rhesus monkeys; the introduction of a new technique for the identification of antibody forming cells *in vitro* and the interpretation of the post-thymectomy wasting syndrome as a form of autoimmune disease. Author

N67-10591# United Kingdom Atomic Energy Authority, Amersham (England). Radiochemical Centre.
THE PULMONARY EXCRETION OF CARBON-14 DIOXIDE FOLLOWING CONTAMINATION OF THE SKIN BY LABELLED CHLORELLA EXTRACT
D. A. Cook Jun. 1966 12 p refs
(RCC-R-179) HMSO: 2s 6d

The results are given of some measurements of the specific activity of exhaled Carbon-14 dioxide following accidental skin contamination by labelled Chlorella extract. Curves showing the variation of specific activity with time and the time integral of the excretion are given. A comparison of these results with those obtained by urine sampling is included. Author

N67-10751*# Massachusetts Inst. of Tech., Cambridge.
THE VESTIBULAR SYSTEM AND HUMAN DYNAMIC SPACE ORIENTATION
Jacob L. Meiry (Ph.D. Thesis) Washington, NASA, Oct. 1966 204 p refs
(Grant NsG-577)
(NASA-CR-628) CFSTI: HC $3.75/MF $1.25 CSCL 06S

The motion sensors were studied to determine their role in human dynamic space orientation and manual vehicle control. Control models for the sensors, descriptions of the subsystems for eye stabilization, and motion cue effects on closed loop manual control were obtained. The subjects' abilities to perceive a variety of linear motions provided data on the dynamic characteristics of the otoliths, and angular acceleration threshold measurements were made. The contributions of the vestibular system, the neck rotation proprioceptors, and the visual system were identified. Compensatory eye movements in response to neck rotation were demonstrated. In human compensatory tracking investigations, motion cues sensed by the vestibular system and tactile sensation were found to enable the operator to generate more lead compensation than in simulation with visual input only. Tracking performance in an unstable control system was shown to depend heavily on the rate information provided by the vestibular sensors. N.E.N.

N67-10841# Oak Ridge National Lab., Tenn. Biology Div.
REPAIR OF DNA
R. B. Setlow [1966] 31 p refs Presented at the Intern. Symp. on Regulatory Mech. in Nucleic Acid and Protein Biosyn., Lunteren, Netherlands, 5–10 Jun. 1966
(Contract W-7405-ENG-26)
(ORNL-P-2240; CONF-660620-1) CFSTI: HC $2.00/MF $0.50

Biological and physico-chemical evidence for the existence of repair systems for DNA is reviewed. Results of studies of the response of viruses, bacteria, and mammalian cells to uv and X-radiation are summarized. It is concluded that the biological data indicate that repair systems operate to remove damage from DNA. Reaction mechanisms involved are discussed and the biological systems and the physico-chemical lesions that have been related to the various steps involved in repair by excision are cataloged. NSA

N67-10844# Philadelphia General Hospital, Pa.
THE EFFECT OF X-RAY IRRADIATION ON PHOSPHOLIPID METABOLISM Progress Report, 1 Oct. 1965–31 May 1966
Henry P. Schwarz 31 May 1966 18 p ref
(Contract AT(30-1)-1864)
(NYO-1864-23) CFSTI: HC $1.00/MF $0.50

Progress is reported in studies on the phospholipid content and chemical composition of phospholipids in blood plasma of men and rats; the effects of X-radiation doses of 2000 to 3000 R on the total phospholipids in rat liver fractions and blood plasma; and the effects of stress caused by acceleration of healthy men at 3 to 4 G for 10 sec on total phospholipid and phosphatidylglycerol content in plasma. The syntheses of phosphatidylglyceral, tritium-labeled phosphatidylglycerophosphate, and a new cardiolipin are described. NSA

N67-10852# Massachusetts General Hospital, Boston. John Collins Warren Labs.
AN INVESTIGATION ON THE MECHANISMS AND REGULATIONS OF NUCLEIC ACID AND PROTEIN SYNTHESIS, AND THEIR POSSIBLE RELATIONSHIP TO RADIATION DAMAGE Progress Report, 1 Sep. 1965–31 Aug. 1966

Paul C. Zamecnik and Joseph W. Gardella 22 Jun. 1966 51 p refs
(Contract AT(30-1)-2643)
(NYO-2643-22) CFSTI: HC $3.00/MF $0.30

Progress is reported in tracer studies of control mechanisms and regulators of nucleic acid and protein synthesis. Topics discussed include the structure of transfer RNA; activation reactions for protein synthesis; the chemical modification of enzyme systems controlling nucleic acid and protein synthesis; the fractionation of transfer RNA; the effects of uv radiation on the formation of transfer RNA in *E. coli;* the synthesis of RNA in regenerating rat liver; and effects of virus infection on the synthesis of RNA in cultured chick embryo cells. A list is included of 17 publications during the period covered by this report. NSA

N67-10883*# Pittsburgh Univ., Pa. Graduate School of Public Health.
[CONTRACT TO EXTEND THE USEFULNESS OF CYTOGENETIC METHODOLOGY AS A RESEARCH TECHNIQUE AND AS A BIOMEDICAL MONITORING PROCEDURE] Quarterly Progress Report, 1 Jan.–30 Jun. 1966
Niel Wald 3 Oct. 1966 10 p
(Contract NASr-169)
(NASA-CR-79746; QPR-10) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Details are given on the automatic cytogenetic analysis system which consists of a digital computer, an ultra-precision flying spot scanner, and a mechanized microscope with either an incoherent or a coherent light source. The subsystems and their functions are described, along with the mode of system operation. The functions to be performed are listed as (1) detection of mitotic cells; (2) placement of mitotic cells under optical miscroscope; (3) focussing of microscope; (4) classification of mitotic cells as suitable for chromosome count only, or suitable for chromosome count and karyotype (matching of appropriate parts of chromosomes); and (5) analysis of the cell, and output of the results by means of photograph, printed page, or magnetic tape. M.G.J.

N67-10896*# Dartmouth Coll., Hanover, N. H. Dept. of Biological Sciences.
EFFECTS OF PLANT GROWTH HORMONES ON PLANT DEVELOPMENT IN THE ABSENCE OF GRAVITATIONAL EFFECTS. THE EFFECT OF WEIGHTLESSNESS ON THE GROWTH AND ORIENTATION OF ROOTS AND SHOOTS OF MONOCOTYLEDONOUS SEEDLINGS
Charles J. Lyon 6 Oct. 1966 48 p refs
(NASA-CR-79712) CFSTI: HC $2.00/MF $0.50 CSCL 06C

CONTENTS:

1. EFFECTS OF PLANT GROWTH HORMONES ON PLANT DEVELOPMENT IN THE ABSENCE OF GRAVITATIONAL EFFECTS C. J. Lyon 11 p refs (See N67-10897 01-04)
2. THE EFFECT OF WEIGHTLESSNESS ON THE GROWTH AND ORIENTATION OF ROOTS AND SHOOTS OF MONOCOTYLEDONOUS SEEDLINGS C. J. Lyon 37 p (See N67-10898 01-04)

N67-10897*# Dartmouth Coll., Hanover, N. H. Dept. of Biological Sciences.
EFFECTS OF PLANT GROWTH HORMONES ON PLANT DEVELOPMENT IN THE ABSENCE OF GRAVITATIONAL EFFECTS Final Report, Sep. 1, 1964–Aug. 31, 1966
Charles J. Lyon *In its* Effects of Plant Growth Hormones on Plant Develop. in the Absence of Gravitational Effects 6 Oct. 1966 11 p refs (See N67-10896 01-04) CFSTI: HC $2.00/MF $0.50
(Grant NsG-231)

The use of radioactive auxin in studies to establish the basis for axial curvature in terrestrial plants is discussed, along with the effect of gravity on the slow transport of auxin through defoliated axes of tall Coleus plants. Retarded growth of internodes that develop on horizontal clinostats is reported for seedling tomatoes and Torenias. Tumbling motion is reported to be as effective as rotation in the horizontal position for preventing lateral transport of auxin by gravity. Refinemement of the wheat seedling experiment is reported, including techniques for growing uniform seedlings and thermal vacuum testing of the spacecraft. M.W.R.

N67-10898*# Dartmouth Coll., Hanover, N. H. Dept. of Biological Sciences.
THE EFFECT OF WEIGHTLESSNESS ON THE GROWTH AND ORIENTATION OF ROOTS AND SHOOTS OF MONOCOTYLEDONOUS SEEDLINGS Annual Status Report, 1 Jul. 1965–30 Jun. 1966
Charles J. Lyon *In its* Effects of Plant Growth Hormones on Plant Develop. in the Absence of Gravitational Effects 6 Oct. 1966 37 p (See N67-10896 01-04) CFSTI: HC $2.00/MF $0.50
(Contract NAS2-1558)

Culture techniques, plant organ orientation to gravity, and growth of uniform wheat seedlings within the flight hardware of a biosatellite are reported. Refinements in techniques are concerned with topics such as lateral curvatures of the primary root, soak and hold times, surplus water, and uniformity of vermiculite pack. Rubber caps for seed stalk arms, burning of slits in the rubber caps, and injection of stalks are also considered. Use of the stalk method for growth of oat seedlings, and a holder system for dicotyledonous seedlings are discussed. Aspects of the physiology of seedling organ orientation include: (1) apical dominance of primary root, (2) treatments with exogenous auxin, (3) maintaining angular orientation of roots, and (4) alternation of growth position. Biocompatibility tests of the flight package, conducted outside the spacecraft, established the adequacy of the hardware; and retardation of seed germination, which occurred when the package was used for a 3-day growth test within the spacecraft while the capsule was held within a thermal vacuum test chamber, was attributed to the heater blankets. M.W.R.

N67-10908# Tennessee Univ., Knoxville. Dept. of Zoology and Entomology.
A STUDY OF THE EFFECTS OF RADIATION ON HOST-PARASITE RELATIONSHIPS Progress Report, Jun. 1954–Jun. 1966
Arthur W. Jones 15 Jun. 1966 12 p refs
(Contract AT(40-1)-1749)
(TID-23114) CFSTI: HC $1.00/MF $0.50

Progress is reported in studies of the effects of X-radiation on host–parasite relationships. The effects of radiation on six species of cestode, seven species of final vertebrate hosts and a number of intermediate invertebrate hosts of these parasites were investigated. Data are summarized on the life cycle, cytology, histopathology in intermediate hosts, effects of whole-body radiation on final hosts, the survival of heavily irradiated larvae, and immune reactions of hosts to the dog tapeworm, cat tapeworm, rat tapeworm, salamander tapeworm, mouse tapeworm, and other related studies. NSA

N67-10925# Washington Univ., Seattle.
THE INFLUENCE OF BORDERS ON INCREMENT THRESHOLDS
Davida Y. Teller [1965] 16 p refs Presented at the Psychonomic Soc., Chicago, 14–16 Nov. 1965
(Contract DA-49-193-MD-2713)
(PLR-17A;AD-639353) CFSTI: HC $1.00/MF $0.50

Previous investigators have reported that increment thresholds are elevated in the regions of abrupt spatial changes of adapting field intensity, known as borders or edges. Such effects have often been attributed to lateral physiological interactions, particularly lateral inhibition, within the visual system. An attempt was made to determine empirically the actual cause or causes of the elevated thresholds on the high intensity side of a border. These elevated thresholds are tentatively attributed to the combined influence of two factors: involuntary eye movements, which produce frequent changes of retinal illuminance near the border; and transient elevations in the increment threshold which occur near the times of large, rapid changes in retinal illuminance. It is concluded that short-term lateral interactions have little if any influence on increment thresholds on the high intensity side of a border. The possibility remains, however, that such increment thresholds may be influenced by lateral interactions whose effects take an extended period of time to develop. Author (TAB)

N67-10944# Chicago Univ., Ill. Toxicity Lab.
MODIFICATION OF THE RADIATION-INDUCED INCREASE IN ADENOSINE TRIPHOSPHATASE ACTIVITY OF THE SPLEEN BY VARIOUS CHEMICAL AGENTS, 1 DECEMBER 1965–31 MAY 1966
Robert O. Tardiff and Kenneth P. Du Bois Jun. 1966 29 p refs
(Contract AF 04(609)-2977)
(AD-637576) CFSTI: HC $2.00/MF $0.50

A study was conducted on the influence of various chemical agents and biological preparations on the radiation-induced increase in adenosine triphosphatase activity of the spleen of rats using cobalt gamma radiation exposures. Exposure of rats to 21.2 r and 50 r per day over a 10-hour period caused dose-dependent increases in enzyme activity. Progressive increases occurred during the first few days followed by maintenace of the activity at a constant elevated level. Chemical agents were tested for protective activity by exposing rats to a total dose of 200 r at the rate of 50 r per day which resulted in an increase in enzyme activity of the spleen to 186% of normal. Cysteine, mercaptoethylamine, and 2-aminoethylisothiouronium (AET) were relatively ineffective in reducing the amount of change in enzyme activity in contrast to their protective effects against acute radiation injury. p-Aminopropiophenone, hydroxylamine, thyroxin, and thyroid stimulating hormones were effective antagonists of the radiation-induced injury. Progesterone and adrenal cortical extract exerted some protective action. A yeast extract and the water-soluble fractions of liver exerted marked protective effects when given parenterally but were ineffective when given orally. Author (TAB)

N67-10968# New York Eye and Ear Infirmary, N. Y.
INVESTIGATION OF THE EFFECTS OF RUBY LASER RADIATION ON OCULAR TISSUE
Jerry H. Jacobson, Harold W. Najac, and Bossom Cooper Phila., Pa., Frankford Arsenal, Jun. 1966 34 p ref
(Contract DA-36-038-AMC-685(A))
(FA-R-1815; AD-638917) CFSTI: HC $2.00/MF $0.50

A series of laboratory and field experiments on rabbits were conducted by the New York Eye and Ear Infirmary in order to establish tentative safe operational distances and conditions for use of the Frankford Arsenal XM23 laser rangefinder. The measured far field corneal threshold dose for rabbits was tentatively determined to be 5×10 to the minus 7th power joule/sq. cm. From this a possible human corneal threshold was calculated as 0.00000145 joule/sq. cm. Based on this value, tentative safe operational distances were calculated as being 6460 meters for night (8 mm pupil), 1615 meters for twilight (4 mm pupil), and 914 meters for daylight (3 mm pupil). Author (TAB)

N67-10998# Ohio State Univ., Columbus.
MEASUREMENT OF COMPLIANCE AND RESISTANCE OF THE LUNGS AND THORAX BY THE USE OF EXPIRATORY FLOW-VOLUME CURVES Technical Report, Jul. 1963–Jun. 1965
William Raymond Carpentier (M.S. Thesis) Wright-Patterson AFB, Ohio, AMRL, Apr. 1966 39 p refs
(Contract AF 33(657)-11698)
(AMRL-TR-66-12; AD-638745) CFSTI: HC $2.00/MF $0.75

Compliance and resistance of the lungs and thorax system were measured in five healthy subjects by a method using relaxed expiratory flow-volume curves. Determinations were made during normal shirt-sleeve conditions and with the subjects suited in ventilated full pressure suits and in anti-G suits inflated to 3 psi. Vital capacity, inspiratory capacity and expiratory reserve volume were also measured under the three conditions. A significant correlation was found between the volume of air inspired above Functional Residual Capacity (FRC) expressed as percentage of normal vital capacity and peak flow reached under normal conditions. No significant correlation was found between the volume of air inspired above FRC and the slope of the V – V curve. Vital capacity and expiratory reserve volume were reduced when the subjects were in pressure suits and anti-G suits, but there was no significant change in inspiratory capacity. A reduction in FRC is implied. Author (TAB)

N67-11008# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
TOXICOLOGICAL EVALUATION OF MATERIALS ASSOCIATED WITH SPACECRAFT
Kenneth C. Back Jun. 1966 13 p refs Presented at the AIAA/ASME 7th Struct. and Mater. Conf., Cocoa Beach, Fla., Apr. 1966
(AMRL-TR-66-69; AD-639060) CFSTI: HC $1.00/MF $0.50

The Air Force has pursued research in areas of ground support and space cabin toxicology for the past 5 years. Comprehensive treatment of toxicological problems in both areas has revealed the necessity to define human tolerance limits to propellants and other toxic materials for various durations of exposure. Hence, an integrated input of propellant and space cabin material toxicology provides the basis for selection of habitable cabin atmospheres and materials selection criteria. Since such selection procedures are based on both biological and engineering considerations, one cannot disregard the materials selection aspect or evaluate closed system toxicology without consideration of source. The toxic materials in space system atmospheres are determined primarily by the qualitative and quantitative composition of space cabin equipment and the contribution of contaminants by the crew. Materials selection and analytical studies on gas-off products are key considerations in controlling toxic contaminants in a space cabin. Methods are described to determine the composition of cabin materials gas-off products and to biologically test these compounds for their toxicological effects. An attempt is made to correlate the roles of the materials analytical chemist and the toxicologist as a working team to provide meaningful and useful materials selection criteria. Author (TAB)

N67-11017# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aerospace Medical Inst.
STUDIES ON THE RESPONSE TO ACUTE ALTITUDE EXPOSURE WITH SPECIAL REFERENCE TO THE POSSIBILITY OF EARLY DETECTION OF HIGH ALTITUDE PULMONARY EDEMA
Hugh S. Pratt, E. Peter Beck, Le Roy S. Wirthlin, and Ashton Graybiel May 1966. 35 p refs
(NAMI-964; AD-639467) CFSTI: HC $2.00/MF $0.50

The pathogenesis of acute pulmonary edema of high altitude remains unknown. The present study was designed to evaluate the baseline and acute cardiorespiratory acclimation data of a group

of young males selected to construct and maintain a scientific station on the Antarctic Plateau (pressure altitude 13,500 feet). Should serious altitude sickness or pulmonary edema develop in any of these subjects, it might be possible to determine which investigations, if any, could be used to screen potentially susceptible subjects and to identify avenues for more extensive studies. The baseline studies revealed the subjects to be in good health. The acute cardiorespiratory changes, both in the altitude chamber at 14,000 feet after 36 hours and following return to sea level, were similar to those described by other authors. No evidence of overt or insipient pulmonary edema was detected. However, there was an unexpectedly high incidence of protracted nausea and vomiting, necessitating the removal of two of the subjects from the chamber
Author (TAB)

N67-11059# Wisconsin Univ., Madison.
ISOLATION, NUTRITION AND METABOLISM OF PHOTOSYNTHESIZING PLANT TISSUE Final Technical Report
A. C. Hildebrandt Army Natick Labs., Mass., Aug. 1966 36 p refs
(Contract DA-19-129-QM-1817(N))
(FD-52; TR-67-12-FD; AD-637848) CFSTI: HC $2.00/MF $0.50

There appears a great potential in tissue cultures of higher plants as a means of producing an abundant supply of fresh, edible, tasty, nutritious plant food for gas exchange in difficult situations and in space travel. Chlorophyllous and nonchlorophyllous strains of edible plant tissues have already been established from many plant species. The requirements for growth and chlorophyll production are influenced by the composition of the medium on which they are grown and by other environmental factors, including light, temperature and acidity of the medium. Nitrate is an excellent source of nitrogen. Tissues grown in liquid media on a shaker or in aerated media tend to fragment into single cells and small clumps of cells. Tissues on agar media may be grown as undifferentiated masses of cells or may be induced to differentiate roots, stems, leaves and plants by modifying the nutrient and other environments. Under space conditions the chlorophyllous tissues would have unlimited sunlight as energy for photosynthesis, would utilize carbon dioxide, and would produce oxygen in the process of synthesizing carbohydrate for food. Such abilities for growth and differentiation as a single cell or as tissue masses and even plants suggest this method has a great built-in potential to select for almost any type of food quality desired Author (TAB)

N67-11074# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF ASCORBIC ACID ON THE ACTIVITY OF SALIVARY AND INTESTINAL GLANDS IN CONDITIONS OF ANOXIA
S. I. Filippovich 18 Apr. 1966 11 p refs Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), no. 8, 1948 p 99–102
(FTD-TT-65-1646; TT-66-62238; AD-638899) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: effect of ascorbic acid on the activity of salivary and intestinal glands in conditions of anoxia.
TAB

N67-11075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF VITAMIN B_1 ON THE ACTIVITY OF SALIVARY AND INTESTINAL GLANDS IN ANOXIA CONDITIONS
S. I. Filippovich 25 Apr. 1966 9 p ref Transl. into ENGLISH from Byull. Eksptl. Biol. i Med. (Moscow), no. 11, 1948 p 387–389
(FTD-TT-65-1647; TT-66-62229; AD-638879) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: effect of vitamin B_1 on the activity of salivary and intestinal glands in anoxia conditions.
TAB

N67-11096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE ROLE OF DIATOMIC AND PERIDYN ALGAES IN SELF PURIFICATION OF SEA WATERS
N. N. Alfimov 17 Jun. 1966 14 p refs Transl. into ENGLISH from Botan. Zh. (Leningrad), v. 44, no. 6, 1959 p 868–872
(FTD-TT-65-1906; TT-66-62353; AD-639491) CFSTI: HC $1.00/MF $0.50

It was found that the Black Sea microscopic algae Prorocentrum micans, Gymnodinium najadeum and Thalassionema nitzschoides which are wide-spread in the plankton, considerably accelerated the destruction of Escherichia coli and Staphylococcus aureus in sea water, thus they promote auto-purification. At the same time, bethic forms of diatomic algae of the Black Sea–Actinocyclus ehrenbergi and Nitzschia closterium–do not produce an essential effect on the rate of necrosis of Escherichia coli and aurous Staphylococcus in sea water. Accumulations of substances, promoting the destruction of Escherichia coli, do not take place in the sea. These substances apparently, are continuously separated by algae in the process of their activity and are rapidly destroyed.
Author (TAB)

N67-11097# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPLEX METHOD OF STUDYING THE FUNCTIONS OF MAN'S TASTE ANALYZER
A. I. Vasil'yev 17 Jun. 1966 20 p refs Transl. into ENGLISH Tr. Inst. Fiziol. Akad. Nauk SSSR (Moscow), no. 6, 1957 p 172–182
(FTD-TT-65-1915; TT-66-62331; AD-639426) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: complex method of studying the functions of man's taste analyzer. TAB

N67-11109*# Mississippi State Univ., State College. Dept. of Microbiology.
INFLUENCE OF METABOLIC ACCUMULATION OF PRODUCTS OF HYDROGENOMONAS CELLS ON THEIR CONTINUED GROWTH Progress Report, 1 May–31 Oct. 1966
Robert G. Tischer 31 Oct. 1966 11 p refs
(Grant NsG-650)
(NASA-CR-79832; PR-5) CFSTI: HC $1.00/MF $0.50 CSCL 06M

Fructose was found to be the only sugar that could be metabolized by *Hydrogenomonas eutropha*, although no fructose was detected in a spent medium. Other sugars, which were identified by paper chromatography could not be oxidized by either autotrophically or heterotrophically grown cells; nor could these sugars support the growth of the organism. Mutation studies have revealed auxotrophic mutants which produce polysaccharides; and the isolation of these polysaccharide-producing hydrogen-utilizing microorganisms is discussed. Large batch culture apparatus studies are reported. M.W.R.

N67-11111# Joint Publications Research Service, Washington, D. C.
NITROGEN METABOLISM IN THE BRAIN OF RATS SUBJECTED TO THE ACTION OF IMPULSE ACCELERATIONS
Z. S. Gershenovich, A. Z. Gershenovich, L. A. Odnokrylaya, E. Z. Emirbekov, and Ya. I. Veksler 28 Oct. 1966 7 p refs Transl. into ENGLISH from Vopr. Med. Khim. (Moscow), v. 22, no. 3, May–Jun. 1966 p 262–264
(JPRS-38380; TT-66-34806) CFSTI: $1.00

Impulse acceleration of between 4 and 10 g resulted in increased concentrations of ammonia in the brains of rats that were placed in a hermetically sealed chamber and subjected to explosion waves of 250 to 300 m/sec^2. There was a decrease in glutamine, while glutamic acid content remained at about the same level. There was even greater liberation of ammonia at impulse accelerations of between

10 and 24 g; labile amido groups showed a decrease of 35.7%. Other experiments at the higher acceleration were conducted on 10 rats; three of these perished and the rest remained in a grave state. Ammonia content increased markedly; glutamine decreased considerably; and labile amido groups decreased by 44.1%, while firmly bound groups decreased by 22.5%. M.W.R.

N67-11125# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF PHYSICAL PARAMETERS OF VIRAL AEROSOLS
A. I. Gromyko, A. I. Danilov, and G. Ya. Vlasenko 17 Oct. 1966 8 p refs Transl. into ENGLISH from Zh. Mikrobiol. Epidemiol. i Immunobiol. (Moscow), no. 7, 1966 p 94–97
(JPRS-38174; TT-66-34601) CFSTI: $1.00

An investigation of the condition of the aerosol cloud in an IVK-2 chamber and the significance of changes observed for the dosimetry of aerosol infection in animals is reported. Determinations were made of the concentration of dispersed substances in an aerosol state, along with correlations between the changes in this concentration and the time of animals' contact with the viral aerosol. Determinations were also made of the fractional composition of aerosols, and the quantity of aerosol passing through the lungs of animals. C.T.C.

N67-11126# Joint Publications Research Service, Washington, D. C.
DETERMINATION OF THE ANTICHOLINESTERASE ACTIVITY OF ORGANOPHOSPHORUS INHIBITORS
A. P. Brestkin, I. L. Brik, and A. A. Sagal 28 Oct. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 167, no. 4–6, 1966 p 1831–1834
(JPRS-38381; TT-66-34807) CFSTI: $1.00

Chemical kinetic equations regarding the inhibition of the enzymatic hydrolysis of acetylcholine by organophosphorus inhibitors, are derived. The effects of changes in the active concentration of the enzyme and enzyme inhibitor and of the incubation time on the hydrolysis rate, are considered, and data are given. Calculations indicate that the phosphorilation rate constant $k_6 = 0.241\ min^{-1}$ is of the same order of magnitude as the alkaline hydrolysis rate constant $k_h = 0.141/$mole min found experimentally. The rate constant k_6 in the calculations is more than twice as large as that of $k_{II,O}$ and thus the enzyme becomes almost completely tied up by the inhibitor in the form of an intermediate complex in a very short time. This assures a fast rate of enzyme phosphorilation. L.S.

N67-11154# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TOXIC EFFECT OF HIGH OXYGEN PRESSURES ON THE ANIMAL ORGANISM
S. I. Prikladovitskiy 11 Aug. 1966 23 p refs Transl. into ENGLISH from Fiziol. Zh. SSSR (Moscow), v. 20, no. 3, 1936 p 507–517
(FTD-TT-65-1983; TT-66-61416; AD-639339) CFSTI: HC $1.00/MF $0.50

A high oxygen partial pressure has various effects on young white mice depending upon their age. The intraperitoneal, subcutaneous and intracapital introduction of wormtree essence in adult white mice causes the appearance of spasms analogous to the ones which are detected during intravenal injection of the preparatus into dogs. The 'threshold' dosage of wormtree amounts for adult white mice is 0.025 g per 100 g of animal weight. Young white mice react to intraperitobal injection of wormtree differently, depending upon age. An intraperitonael introduction of strychnine solution (1:2000) in white mice causes accidents of typical 'strychnine' pains. Three age brackets for the irritation of the cortex by electrical and chemical irritants can be established in white mice. In totality these results confirm the assumption that spasms, which appear in warm blooded animals under the effect of high partial oxygen pressures, are the result of an irritation in the cerebral cortex. Author (TAB)

N67-11176# IIT Research Inst., Chicago, Ill.
DEVELOPMENT OF EDIBLE MOUTH COOLANTS Final Report
Richard W. Sroges Natick, Mass., Army Natick Labs., Jun. 1966 26 p
(Contract DA-19-129-AMC-96(N))
(FD-61; TR-66-53-FD; AD-638427) CFSTI: HC $2.00/MF $0.50

The report covers investigations relative to the selection and evaluation of edible substances that could alleviate the oral discomfort associated with thirst. A discussion is also made relative to the rationale of tests that utilize animals to screen substances for thirst-alleviating properties, screening tests that were evaluated, and description of the procedure used in experiments in which human taste panels were utilized to evaluate four substances that appeared to be effective in preliminary tests. Results of the taste panel experiments are also reported. (Author) TAB

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N67-10149# Dunlap and Associates, Inc., Santa Monica, Calif.
ADAPTIVE SIMULATION Final Report
Charles R. Kelley 15 Aug. 1966 94 p refs
(Contract Nonr-4986(00))
(AD-637658) CFSTI: HC $3.00/MF $0.75

CONTENTS:
1. INTRODUCTION (PROJECT REPORT) C. R. Kelley 2 p
2. DESIGN APPLICATIONS OF ADAPTIVE (SELF-ADJUSTING) SIMULATORS C. R. Kelley 36 p refs (See N67-10150 01-05)
3. CROSS-ADAPTIVE OPERATOR LOADING TASKS C. R. Kelley and M. J. Wargo 21 p refs (See N67-10151 01-05)
4. SELF-ADJUSTING VEHICLE SIMULATORS C. R. Kelley 21 p refs (See N67-10152 01-05)

N67-10150# Dunlap and Associates, Inc., Santa Monica, Calif.
DESIGN APPLICATIONS OF ADAPTIVE (SELF-ADJUSTING) SIMULATORS
Charles R. Kelley *In its* Adaptive Simulation 15 Aug. 1966 36 p refs Presented at the MIT-NASA Working Conf. on Manual Control, Cambridge, Mass., 28 Feb.–2 Mar. 1966 Submitted for Publication (See N67-10149 01-05) CFSTI: HC $3.00/MF $0.75

The usefulness for manual control system design of adaptive (self-adjusting) simulators is reviewed. The history of adaptive simulation is outlined, and an analytical development presented. Recommended equations and procedures for adaptive applications are reported with respect to display gain, continuous versus on-off control, and one versus two versus three-axis tasks. Data were gathered in each case on an acceleration control task, in which forcing function amplitude was varied adaptively. The relation of each design variable to forcing function amplitude, with operator error constant, is described for the example task. R.L.

N67-10151# Dunlap and Associates, Inc., Santa Monica, Calif.
CROSS-ADAPTIVE OPERATOR LOADING TASKS
Charles R. Kelley and Michael J. Wargo *In its* Adaptive Simulation 15 Aug. 1966 21 p refs (See N67-10149 01-05) CFSTI: HC $3.00/MF $0.75

Various methods dealing with the homeostatic tendency in task activity and other factors affecting human performance are reviewed. Described are the cross-adaptive operator loading tasks illustrating adaptive techniques by means of which performance on one (primary) task modifies a second (operator loading) task in such a way that primary task performance is standardized, and all of the variance transferred to the loading task score. Experimental data are compared for: performance with a primary task alone, a primary plus independent loading task, and a primary plus cross-adaptive loading task. Rules for the application of cross-adaptive loading tasks are included. R.Li.

N67-10152# Dunlap and Associates, Inc., Santa Monica, Calif.
SELF-ADJUSTING VEHICLE SIMULATORS
Charles R. Kelley *In its* Adaptive Simulation 15 Aug. 1966 21 p refs Presented at the Intern. Congr. on Human Factors in Electron., Long Beach, Calif., 3–4 May 1962 (See N67-10149 01-05) CFSTI: HC $3.00/MF $0.75

The general concept and techniques for employing operator performance measurements to adjust the internal characteristics of a vehicle simulator or tracking system are examined. A proposed vehicle simulator was set up in the laboratory as a part of the predictor instrument research program, and proved useful not only for training, but also for research on design problems, and for selection of operators (pilots). A figure depicts an analog computer circuit used for obtaining S, the score which brings about the variation in the self-adjusting simulator. A block diagram portrays the self-adjusting system to vary the amplitude of a forcing function in proportion to S. While the usefulness of the self-adjusting vehicle simulator for selection is dependent on measuring a threshold of skill simply and accurately, the usefulness of the device as a trainer rests with keeping the trainee performing at the margin of his skill, whatever this skill level may be. R.Li.

N67-10157# Joint Publications Research Service, Washington, D. C.
THE SUBJECT MATTER OF SEMIOTICS
A. A. Vetrov *In its* Some Aspects of Inform. Theory and its Relation to Living Organisms 16 Nov. 1965 p 1–16 refs (See N67-10156 01-04) CFSTI: $2.00

A definition of the science of semiotics is proposed, and its three divisions (pragmatics, semantics, and syntactics) are discussed. It is considered that semiotics is the general science of signs (both language and non-language), the meanings of signs, and those properties of sign systems in which the specific nature of the functioning of signs in those systems is revealed. It is suggested that this definition of semiotics establishes a precise boundary between semiotics as a special science, and other sciences (logic, mathematics, linguistics, etc.). R.Li.

N67-10173*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
RESEARCH ON NEW TECHNIQUES FOR THE ANALYSIS OF MANUAL CONTROL SYSTEMS Progress Report, 15 Dec. 1965–15 Jun. 1966
George A. Bekey 15 Jun. 1966 24 p refs
(Grant NGR-05-018-022)
(NASA-CR-79386; USCEE-177; PR-2) CFSTI: HC $1.00/MF $0.50 CSCL 05H

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1. MANUAL CONTROL DATA ACQUISITION FACILITY M. J. Merritt and S. H. Shaar p 2–3 (See N67-10174 01-11)
2. PULSE MODELS OF HUMAN OPERATORS PERFORMING COMPENSATORY TRACKING WITH COORDINATED MULTIPLE INPUTS M. J. Merritt, C. Jacobs, and G. A. Bekey p 4–10 (See N67-10175 01-05)
3. RANDOM PARAMETER MODELS OF HUMAN CONTROLLERS S. M. Brainin and G. A. Bekey p 11–15 (See N67-10176 01-05)
4. FINITE-STATE MODELS OF MANUAL CONTROL SYSTEMS E. S. Angel and G. A. Bekey p 16–17 (See N67-10177 01-05)

N67-10175*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
PULSE MODELS OF HUMAN OPERATORS PERFORMING COMPENSATORY TRACKING WITH COORDINATED MULTIPLE INPUTS
M. J. Merritt, C. Jacobs, and G. A. Bekey *In its* Res. on New Tech. for the Analysis of Manual Control Systems 15 Jun. 1966 p 4–10 (See N67-10173 01-05) CFSTI: HC $1.00/MF $0.50

An asynchronous, pulse-amplitude, pulse-width model of a human operator was synthesized, and an attempt made to extend the same general approach to compensatory tracking systems with more than one input. During the control task training, the operator was instructed to maintain constant altitude while flying over bumpy terrain. The operator inputs were obtained from two display devices separated by 30° of eye rotation which present pitch angle and altitude error. The technique for determining the eye motion by measuring the subject's electro-ocular potential was considered successful. R.Li.

N67-10176*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
RANDOM PARAMETER MODELS OF HUMAN CONTROLLERS
S. M. Brainin and G. A. Bekey *In its* Res. on New Tech. for the Analysis of Manual Control Systems 15 Jun. 1966 p 11–15 (See N67-10173 01-05) CFSTI: HC $1.00/MF $0.50

Tentative results are presented on a research project to identify random variables used in modeling manual control tracking performance. The statistical properties of human operator models with random parameters were studied, and regression analysis and digital computer methods for solving the problem are mentioned. Tables show the digital processing of eight-second samples of the tracking data. R.Li.

N67-10177*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
FINITE-STATE MODELS OF MANUAL CONTROL SYSTEMS
E. S. Angel and G. A. Bekey *In its* Res. on New Tech. for the Analysis of Manual Control Systems 15 Jun. 1966 p 16–17 (See N67-10173 01-05) CFSTI: HC $1.00/MF $0.50

The finite-state machine theory application to manual control, and the development of models of tracking behavior are reported. The adaptation procedure described involves setting more sensitive threshold levels on the error and error rate gates in response to decreasing errors. It is stated that this new model is simulated by a computer. R.Li.

N67-10228*# National Aeronautics and Space Administration, Washington, D. C.
GRAPHIC METHOD OF RECORDING PULSE [METOD GRAFICHESKOY REGISTRATSII PUL'SA]
V. V. Sychev Oct. 1966 4 p Transl. into ENGLISH from Voenno-Med. Zh. (Moscow), v. 12, 1956 p 83–84
(NASA-TT-F-10362) CFSTI: HC $1.00/MF $0.50 CSCL 06B

A brief description is given of an inertialess method of recording pulse which utilizes the electronic cardioscope and a piezoelectric sensor as the receptor. Author

N67-10278# Technology, Inc., Dayton, Ohio.
THE MOTION OF THE HUMAN CENTER OF MASS AND ITS RELATIONSHIP TO THE MECHANICAL IMPEDANCE Final Report, 1 Jan.–31 Dec. 1964
Edmund B. Weis, Jr. (AMRL) and Frank P. Primiano, Jr. Wright-Patterson AFB, Ohio, AMRL, Jun. 1966 25 p refs Prepared jointly with AMRL
(Contract AF 33(657)-10010)
(AMRL-TR-65-50; AD-637182) CFSTI: HC $1.00/MF $0.50

The report concerns the development of a relationship between the human mechanical impedance and the coupling of the human center of mass to the environment. The mechanical impedance is a common analysis tool in biomechanics while the analysis of the coupling of the center of mass to the environment is technically more difficult, if not impossible. The development is based on linear, passive, isotropic theory and shows that the transfer function which expresses the relation between the motion of the center of mass and the motion of the source is similar to a linear second order mechanical system in each of the translational spatial degrees of freedom. Author (TAB)

N67-10292# Geoscience, Ltd., La Jolla, Calif.
WHOLE ORGAN FREEZING AND THAWING HEAT TRANSFER AND THERMAL PROPERTIES Quarterly Report, 1 Apr.–30 Jun. 1966
Heinz F. Poppendiek, Norman D. Greene, and R. Randall 30 Jun. 1966 19 p refs
(Contract Nonr-4095(00))
(GLR-46; AD-638648) CFSTI: HC $1.00/MF $0.50

Progress of research in the following areas is summarized: thermal conductivity and heat capacity of biological fluids and tissues; freeze-thaw heat transfer analysis; rapid thawing of stored organs. TAB

N67-10321# Naval Personnel Research Activity, San Diego, Calif. Navy Training Research Lab.
A REVIEW OF ELECTRONICS TRAINING RESEARCH LITERATURE
Eugene A. Hooprich and John H. Steinemann Aug. 1966 28 p refs
(STB-67-1; AD-638681) CFSTI: HC $2.00/MF $0.50

The review of electronics training literature is designed to augment and update information obtained from a previous evaluative survey of military and civilian electronics training programs. The review is based primarily on available research reports published during recent years and pertaining to the training of electronics personnel in the military services. Five major areas of electronics training research are considered in the review: troubleshooting approaches and trainers, maintenance manuals and other job aids, training course variables, experimental electronics training courses, and training evaluation. General trends in electronics training research are noted, and their relationship to the findings of the previous evaluative survey is discussed. TAB

N67-10339# Washington Univ., Seattle.
[ADMINISTRATION, RESEARCH AND SUPPORT IN PSYCHOPHYSICS AND PSYCHOPHYSIOLOGY] Progress Report No. 4
Eugene Galanter 1 Jun. 1966 18 p refs
(Contract Nonr-477(34))
(PRP-23N; AD-638628) CFSTI: HC $1.00/MF $0.50

The report contains current personnel, types of research accomplished during the past year, plans for the coming year, both administrative and scientific, and a bibliography of technical reports. In addition the report contains a discussion of the role of computer simulation in psychology from a critical point of view Author (TAB)

N67-10372# Naval Medical Research Inst., Bethesda, Md.
DEVELOPMENT OF A COMPLEX, TIME-SHARED, PERCEPTUAL-MOTOR SKILLS TASK FOR USE IN STUDIES OF ISOLATION AND CONFINEMENT
Seward Smith Aug. 1966 24 p refs
(Rept.-15; AD-637817) CFSTI: HC $1.00/MF $0.50

Detailed information is presented about a complex perceptual-motor skills task designed for use in the Naval Medical Research Institute's studies of isolation and confinement. Pilot data are presented demonstrating: (1) that the fully automated task is equally suitable for use during experimental conditions employing darkened or lighted test rooms, and (2) that typical performances are in a range such that either increments or decrements should be easily measurable. Author (TAB)

N67-10399# Joint Publications Research Service, Washington, D. C.
MAN-MACHINE RELATIONSHIPS IN RAILROAD CONTROL
G. A. Krasovskiy 24 Oct. 1966 11 p Transl. into ENGLISH from Avtomat., Telemekhan. i Svyaz (Moscow), no. 4, 1966 p 8–11
(JPRS-38298; TT-66-34724) CFSTI: $1.00

Operational and technological problems affecting the reliability of man-machine interaction in automatic railroad transportation systems are discussed. Proposed is the use of the methods and basic principles of engineering psychology for improving existing systems, and establishing highly efficient railroad automatic systems which focus on the optimization of man and machine functions. S.C.W.

N67-10404# Ritchie and Associates, Inc., Dayton, Ohio.
MANUAL CONTROL OF REMOTE MANIPULATORS: EXPERIMENTS USING ANALOG SIMULATION Final Report, Feb. 1964–Mar. 1965
Sidney Seidenstein and A. G. Berbert, Jr. Wright-Patterson AFB, Ohio, AMRL, Feb. 1966 153 p refs
(Contract AF 33(615)-1456)
(AMRL-TR-66-21; AD-638500) CFSTI: HC $5.00/MF $1.00

An analog simulation of a remote manipulator was developed and used to investigate operator performance as a function of machine design parameters. Independent variables included control order, rate of motion, manipulator dynamics, positioning error tolerance, distance traversed, and duration for which final arm position had to be maintained. Dependent variables were travel time, adjustment time, time on target and total task time. Principal results were as follows: Increasing the complexity of system dynamics produced a decrement in operator performance which was greater for fixed rate than for proportional rate control. Proportional rate control was found to be superior to fixed rate control afforded no advantage over the optimum single level of rate control Author (TAB)

N67-10410# George Washington Univ., Washington, D. C. Human Resources Research Office.
PURSUIT ROTOR PERFORMANCE. I: EFFECTS OF REINFORCING THE LONGER INTERVALS OF CONTINUOUS TRACKING WITHIN EACH TRIAL
Richard W. Sheldon and John F. Bjorklund Jun. 1966 30 p refs
(Contract DA-44-188-ARO-2)
(HumRRO-TR-66-11; AD-638015) CFSTI: HC $2.00/MF $0.50

To determine whether selective reinforcement of pursuit rotor performance facilitates acquisition of skill and promotes its retention, five groups of subjects were individually trained for ten sessions of 15 trials each. Selective reinforcement of longer than

average target contacts was introduced for one group of subjects during Sessions 6 and 7 and for another during Sessions 4 to 7. Continuous reinforcement of target contacts was introduced for two other groups. A control group received no reinforcement. Dependable improvements in time-on-target scores were obtained for all four sessions, but the superior performances were not maintained when reinforcement was withdrawn. The results suggest that this improvement as a function of feedback was attributable to motivational rather than learning or informational effects Author (TAB)

N67-10412# Washington Univ., Seattle.
SOME EXPERIMENTS ON SIMPLE AND CHOICE REACTION TIME
Joan Gay Snodgrass (New York Univ.), R. Duncan Luce (Pa. Univ.), and Eugene Galanter 1 Aug. 1966 55 p refs
(Contract Nonr-477(34))
(PRP-26N; AD-638619) CFSTI: HC $3.00/MF $0.50

The report concerns four problems on simple and choice reaction time (RT). First, in Experiments 1 and 2, the authors examine the role of time estimation in the manipulation of responses in simple reaction time experiments by means of payoffs and information feedback. Second, in Experiment 3, they ask whether the changes in the shape and location of choice RT distributions as compared with simple ones are due primarily to the increase in the number of signals, in the number of responses, or in some more basic difference between the two tasks. Third, in Experiment 4, they investigate the relation between RT and signal presentation probability in choice situations. And, finally, using all of the empirical distributions obtained in Experiments 2, 3, and 4, an attempt is made to see if any of several theoretical distributions appear to give a satisfactory description of the data. Author (TAB)

N67-10413# Washington Univ., Seattle.
SIGNAL DETECTION
Eugene Galanter 1 Aug. 1966 16 p refs
(Contract Nonr-477(34))
(PRP-25N; AD-638618) CFSTI: HC $1.00/MF $0.50

The report is a didactic exposition of the two major theories of signal detection, the limited-state theshold theory and the infinite state signal detectability theory. The report was prepared for inclusion in the 1967 Yearbook of Science and Technology edited by McGraw-Hill Author (TAB)

N67-10445# Bureau of Mines, Pittsburgh, Pa. Health and Safety Research and Testing Center.
A MACHINE-TEST METHOD FOR MEASURING CARBON DIOXIDE IN THE INSPIRED AIR OF SELF-CONTAINED BREATHING APPARATUS
Edwin J. Kloos and Joseph A. Lamonica 1966 14 p refs
(BM-RI-6865)

A new machine test method for measuring carbon dioxide inspired by a wearer of self-contained breathing apparatus was devised. The new method compares favorably in speed and precision with standard man tests in which the apparatus is tested while actually worn, and is scheduled for use in future approval tests for facepiece carbon dioxide measurements. However, man tests will still be used to measure the efficiency of the carbon dioxide sorbent materials in closed circuit breathing apparatus. Author

N67-10466# Medical Biological Lab., RVO-TNO, Rijswijk (Netherlands).
THE EFFICIENCY OF ELECTROSTATIC AIR FILTERS IN A SPF RAT BREEDING UNIT
J. L. F. Gerbrandy, D. van der Waay, and H. C. Bartlema Aug. 1966 8 p refs Supported by EURATOM
(TDCK-46285; MBL-1966-8; RI-1966-8) CFSTI: HC $1.00/MF $0.50

The efficiency of two electrostatic filters supplying two different animal rooms in a SPF rat breeding unit have been tested. Samples taken from filtered, experimentally contaminated, air demonstrated a sufficiently high efficiency of the filters. Author

N67-10479# Royal Air Force, Farnborough (England). Inst. of Aviation Medicine.
FURTHER ASSESSMENT OF CLOTHING COMBINATIONS FOR PROTECTION AT AN ALTITUDE OF 75,000 FEET
D. I. Fryer and P. R. Wagner London, Flying Personnel Res. Comm., Jan. 1965 47 p refs
(FPRC/1232) CFSTI: HC $2.00/MF $0.50

Experiments have been carried out to assess the feasibility of protection against rapid decompression from 25,000 feet to 75,000 feet, and maintenance of that altitude for 1 minute followed by descent at 10,000 ft/min, using readily available garments and equipment. The use of a de-rated Mk 20 regulator, sleeved jerkin and anti-g suit proved unsatisfactory. Analysis of respiratory gas composition by use of the mass spectrometer, recorded that the combination of slight nitrogen contamination of inspired gas from the garment bladders and very low alveolar P_{CO_2} levels following decompression is likely to have summated with the lower breathing pressure given by the de-rated regulator, to give rise to quite severe cerebral hypoxia. Raising the breathing pressure and adoption of the slightly more effective counter-pressure of the new combined sleeved jerkin/anti-g suit, enabled the problem of protection under the specified conditions to be achieved without difficulty. Author

N67-10480# United Kingdom Atomic Energy Authority, Harwell (England). Radiological Protection Div.
ENVIRONMENTAL MONITORING ASSOCIATED WITH DISCHARGES OF RADIOACTIVE WASTE DURING 1965 FROM U.K.A.E.A. ESTABLISHMENTS
Aug. 1966 30 p refs
(AHSB/RP/-R-72)

This report describes the results of the environmental monitoring undertaken to confirm that the discharges of radioactive waste during 1965 from each of the principal UKAEA establishments produced no hazard in the environment. The results of this monitoring are summarised and are compared with derived working limits to facilitate an appreciation of the standards of safety achieved. Author

N67-10527# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
HEALTH PHYSICS TECHNICIAN TRAINING MANUAL
H. W. Stroschein and P. H. Maeser, ed. Jun. 1966 304 p refs
(Contract AT(10-1)-205)
(IDO-17182) CFSTI: HC $7.00/MF $1.50

The general principles of radiation safety covered include the basic principles of radiation, dose determination and limits, biological effects of radiation, radiation detection instrumentation, contamination control, decontamination, and emergency actions. General information is also included on non-radiological safety often associated with health physics work. Author (NSA)

N67-10548# Flying Personnal Research Committee, London (England).
A COMPARISON OF THE PERFORMANCE OF FIVE AIR VENTILATED SUITS AS HEAT EXCHANGERS, MEASURED ON A HEATED MANIKIN
D. Mc K. Kerslake and J. M. Clifford Apr. 1965 25 p refs
(FPRC/1239) CFSTI: HC $1.00/MF $0.50

The thermal performances of five types of air ventilated suit have been compared. Direct measurements were made of effectiveness as an exchanger of sensible heat, and of the skin temperature distribution produced with cool air supplies. Evaporative performance was inferred from these results and consideration of

suit design. Attention is drawn to the possibility of making use of the overlying clothing to simplify the ventilating garment and improve the ventilating performance of the assembly. Author

N67-10578# United Kingdom Atomic Energy Authority, Harwell (England). Health Physics and Medical Div.

PERSONNEL DOSIMETRY FOR NEUTRONS

J. W. Smith Jul. 1966 28 p refs

(AERE-R-5125) CFSTI: HC $2.00/MF $0.50

An experimental determination has been made of the neutron flux backscattered by a phantom. This work formed part of a search for an intermediate energy neutron dosimeter to fill the wide gap in personnel dosimetry between thermal (0.025 eV) and fast (300 keV). The backscattered flux was found to fall only very slowly with energy so that a thermal neutron detector on the surface of the body may be used to measure dose-equivalent up to 5 keV. The measurement or assessment of dose-equivalent and fluence in the region 5 keV to 300 keV is discussed in some detail with the object of providing a complete system of personnel dosimetry for neutrons. Author

N67-10588# United Kingdom Atomic Energy Authority, Harwell (England). Radiological Protection Div.

A FEASIBILITY STUDY OF THE USE OF P.V.C. PRESSURISED SUITS IN WORKPLACE AT TEMPERATURES OF 40 TO 50°C

R. P. Rowlands Aug. 1966 11 p refs

(AHSB(RP)-M-43)

Formulas derived from experiments in which men worked in pressurized suits at ambient temperatures are extrapolated to workplace temperatures in the range 40 to 50°C. It is shown that coating a standard pressurized suit with radiant heat reflecting material and using a vortex tube to cool a dehumidified breathing air supply makes moderate work feasible. At the lower end of the workplace temperature range considered, the thermal conditions for the suit wearer are comfortable. With increasing workplace temperature the thermal stress on the man increases through a zone of modest discomfort to a zone marked discomfort which is barely tolerable. Up to about 46°C exposures of a few hours appear feasible, but between 46 and 50°C it would appear prudent to limit exposures to an hour or so. Above 50°C brief exposures only are indicated. Likely values of the physiological responses, body temperature, heart rate and weight loss through sweating, are given corresponding to the different zones of thermal stress. Author

N67-10596# Library of Congress, Washington, D. C. Aerospace Technology Div.

SPACECRAFT STERILIZATION PROCEDURES IN THE USSR

Boris Mandrovsky 5 Aug. 1966 19 p

An information letter is presented which discusses Soviet sterilization procedures as they have been described at various meetings. It is noted that in the course of the discussions it became apparent that the Soviets did not use a shroud and that they used heat plus some chemical. Abstracted data from four papers by Soviet scientists on sterilization factors are also included. A.G.O.

N67-10671# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.

DEVELOPMENT AND APPLICATIONS OF THERMOLUMINESCENT DOSIMETERS

R. M. Hall 25 May 1966 16 p refs Presented at the Symp. on Med. Phys., Madison, Wis., 9–11 Jun. 1966

(Contract AT(07-2)-1)

(DP-MS-66-29; CONF-660623-1) CFSTI: HC $1.00/MF $0.50

Thermoluminescent dosimeters are being developed at the Savannah River Laboratory for various research programs, environmental surveillance, and personnel monitoring. The upper range of LiF dosimeters was extended to 10^6 R by using a secondary glow peak between 270 and 350°C. From 10 to 10^6 R, the primary glow peak (between 25 and 270°C) and the secondary peak can be used to obtain duplicate results from each dosimeter. With single LiF crystals, exposures as low as 1 mR are measured with an accuracy of ±15% (at the 95% confidence level). Laboratory and field tests showed that thermoluminescent dosimeters were more accurate, reliable, and economical than instruments used previously for measuring environmental radiation. Fading (loss of thermally stimulated luminescence) was found to be primarily due to exposure to sunlight. Laboratory tests indicated LiF faded 13% in 12 days and 21% in 45 days when illuminated by simulated sunlight at 2.5×10^3 foot-candles for 10 hours per day. Dosimeters stored in opaque containers at outdoor stations had faded 4% after one month and 20% after one year. Humidity did not affect response. Thin single crystals (~0.1 mm) or a layer of LiF powder (20 mg/cm^2) have the same response for radium gamma and beta radiation over a range of maximum energies, (0.7 to 2.2 Mev). Rings fabricated from 3 mil polyethylene containing a thin layer of LiF are used to measure hand dose. Capsules containing LiF powder were used at the Medical College of Georgia to measure the radiation doses received during cancer therapy. These small dosimeters accurately measured the dose to the tumor or adjacent tissue. They are also used to measure the dose distribution in tissue equivalent material from new radioactive sources proposed for radiotherapy. Author (NSA)

N67-10769# Battelle-Northwest, Richland, Wash. Environmental Health and Engineering Dept.

PERSONNEL NEUTRON DOSIMETER DEVELOPMENTS

C. M. Unruh, W. V. Baumgartner, L. F. Kocher, L. W. Brackenbush, and G. W. R. Endres 27 Jul. 1966 20 p refs Presented at Symp. for Neutron Monitoring for Radiological Protect., Vienna

(Contract AT(45-1)-1830)

(BNWL-SA-537) CONF-660807-1) CFSTI: HC $1.00/MF $0.50

Three approaches to the problem of personnel neutron dosimetry are discussed. These are thermoluminescence, solid state track detection, and activation analysis. NSA

N67-10886*# California Univ., Los Angeles. Johns Hopkins Univ., Baltimore, Md.

SPECTRAL ANALYSIS TECHNIQUES AND PATTERN RECOGNITION METHODS FOR ELECTROENCEPHALOGRAPHIC DATA

W. R. Adey 1 Sep. 1966 42 p refs Presented at Conf. on Data Process. in Hosp., Elsinore, Denmark, Apr. 1966 Prepared Jointly with Johns Hopkins Univ. *Its* Inform. Exchange Group No. 3

(Contract NAS9-1970; Grants NsG-502; NsG-505; NsG-520; AF-AFOSR-256-63 et al)

(NASA-CR-79743; SM-47) CFSTI: HC $2.00/MF $0.50 CSCL 06B

A data acquisition, analysis, and display system for time-shared use by a group of neurophysiological investigators is described. Applications of spectral analysis to a normative library of EEG data in states of sleep and wakefulness are described, with establishment of baselines for adult males in the course of simple alerting, vigilance task performance, and in visual discriminations of increasing difficulty. Simple pattern recognition techniques were applied to such data from individual subjects, with good accuracy in automated recognition of EEG states accompanying different levels of focused attention. The use of computer analysis in analysis of intraneuronal wave records is described, and a physiological model of genesis of the EEG in a population of neuronal wave generators having independent and nonlinear characteristics is discussed. Possible future trends in electrophysiological data analysis are reviewed. Author

N67-10971# Naval Personnel Research Activity, San Diego, Calif.
AN EXPERIMENT IN BASIC AIRBORNE ELECTRONICS TRAINING. PART I: EFFECT OF REDUCTION IN TRAINING TIME UPON KNOWLEDGE OF ELECTRONICS FUNDAMENTALS
Alexander A. Longo and G. Douglas Mayo Aug. 1966 17 p ref
(STB-67-3; AD-638439) CFSTI: HC $1.00/MF $0.50

This is the first in a series of reports on a longitudinal study pertaining to the question on whether training time can be reduced in basic airborne electronics training through judicious revision of the course. This report compares the relative performance of two matched groups of 154 trainees each, on the basis of a comprehensive examination of knowledge of electronics fundamentals upon completion of the regular course (19 weeks of instruction) and the revised course (14 weeks of instruction). The results indicated that the course reduction of the size undertaken (26%) resulted in less knowledge on the part of the personnel receiving the shorter course, despite the best efforts of experienced training personnel who designed and implemented the shorter course. The difference between the two groups was statistically significant at the .01 level. Author (TAB)

N67-10987# Frankford Arsenal, Philadelphia, Pa.
DYNAMIC PHOTOELASTIC STRESS PATTERNS FROM A SIMPLIFIED MODEL OF A HEAD
Paul D. Flynn Feb. 1966 8 p refs Reprinted
(A66-9; AD-639596)

Photoelasticity is a method of experimental stress analysis employing polarized light and transparent models. Dynamic photoelasticity generally deals with the determination of transient stresses and strains in machine parts or structures subjected to impact or shock loading. The potential value of this technique in head injury research is illustrated by stress patterns of a simplified model of a skull and brain under dynamic loads that were photographed at a rate of 240,000 pictures per second. The results are compared with stress patterns obtained from the same model under static loads. Author (TAB)

N67-10989# Beckman Instruments, Inc., Fullerton, Calif.
ULTRAVIOLET OXYGEN DETECTOR Final Report, Mar.–Dec. 1965
Ronald G. Hughes Wright-Patterson AFB, Ohio, AMRL, Jun. 1966 68 p refs
(Contract AF 33(615)-2383)
(AM-2360-201; AMRL-TR-66-77; AD-639331) CFSTI: HC $3.00/MF $0.75

An ultraviolet oxygen sensor has been investigated, designed, fabricated and tested which is to photoelectrically measure the partial pressure of oxygen in the pressure range from 100 to 500 torr. A krypton source was used to illuminate the Fery prism which is the dispersing element of a dual beam single monochromator set to pass energy in the Schumann-Runge absorption continuum band of oxygen in the wave-length region of 1450 to 1510 A. Since the absorption coefficient of oxygen has an average value of 350/cm in this band, absorption spectroscopy is employed in the measurement of oxygen concentration by passing the selected band of radiation from the monochromator through a .014 cm path length of oxygen gas. By monitoring the change in luminous energy falling on the photocathode of a photomultiplier tube, one can determine the partial pressure of the gas for a specified temperature. Lamberts Law demonstrates the change in intensity for a constant distance and due to the variation of k with a change in pressure. The partial pressure is read out directly on a 0-100 microamp meter which receives the signal from a ratioing, Darlington, current amplifier system. The amplifier obtains the primary signals from the current outputs of two RCA-type CF0129C phototubes positioned to detect light from an absorbing path and a reference path Author (TAB)

N67-10990# Naval Medical Research Inst., Bethesda, Md.
PHYSIOLOGIC MECHANISMS OF MAINTAINING THERMAL BALANCE IN HIGH PRESSURE ENVIRONMENTS
Lawrence W. Raymond Sep. 1966 30 p refs Presented at the 2d Conf. on Marine Systems and ASW, Los Angeles, 10 Aug. 1966, Sponsored by AIAA and Navy
(Rept.-10; AD-639608) CFSTI: HC $2.00/MF $0.50

The review of body temperature control aims to define the optimal environment for deep submergence habitats, at pressures of 15-20 atmospheres. Environmental factors demand major attention since they will largely dictate the physiologic adjustments which will be required. Inherent changes in gas composition and density indicate major increases in surface heat transfer, depending upon atmospheric temperature and movement. Habitat insulation and ocean temperature suggest that body surface heat transfer will also be increased by radiation, but this may be modified by heating techniques, special insulation methods or by treatment of cold habitat surfaces. Humidity may be an important determinant of comfort and skin hygiene. Psychrometric methods for hyperbaric atmospheres are discussed. Experimental data on body heat transfer in helium-rich environments are presented from simulation studies. The data confirm a major increase in convective heat transfer from the skin, in helium at increased pressures. The implications of these findings upon physiologic and environmental aspects of these findings upon physiologic and environmental aspects of deep submergence programs are discussed Author (TAB)

N67-11019# Marine Engineering Lab., Annapolis, Md.
FUNDAMENTALS OF AIR PURIFICATION
W. R. Calvert Aug. 1966 17 p refs Presented at the Symp. on Safety in Air Separation and Ammonia, Pt. 1, 60th Natl. Meeting, Atlantic City, 18–21 Sep. 1966
(MEL-364/66; AD-639582) CFSTI: HC $1.00/MF $0.50

The paper describes phenomena occurring during employment of adsorbents and oxidation catalysts in air purification. (Author) TAB

N67-11035# Naval Air Development Center, Johnsville, Pa.
EXPERIMENTAL RESULTS OF A SIMULATED FLIGHT TEST USING VARIOUS CONTACT ANALOG TEXTURE FORMATS Final Report
Vincent E. Lafranchi 2 Aug. 1966 35 p
(NADC-AM-6645; AD-638794) CFSTI: HC $2.00/MF $0.50

The experiment was performed to investigate whether synthetic ground and sky textures, displayed on a contact analog display, affect the ability of the pilot to follow command symbols presented to him during flight. Ninety-six laboratory simulated flights were flown and errors from prescribed path were recorded on magnetic tape. The data was reduced by a CDC 3200 computer and an analysis of variance was performed. The analysis indicated that no significant changes in errors occurred for the four combinations of ground and sky textures displayed Author (TAB)

N67-11042# School of Aerospace Medicine, Brooks AFB, Tex.
AN EXPLORATORY STUDY OF FACTORS AFFECTING AIRCREW MORALE
Bryce O. Hartman, George K. Cantrell, and Lewis S. Sims Jul. 1966 13 p refs
(SAM-TR-66-62; AD-639141) CFSTI: HC $1.00/MF $0.50

Aircrew morale was studied in 176 MAC aircrewmen. In interviews and questionnaires, nine problem areas were identified. The primary problem reported by the aircrewmen was lack of planned free time. This factor had a negative effect both on duty and off duty. The remaining eight factors were more specific to the working environment. Several were a function of the mission of the command but some were accessible to local modification. In the face of these problems, aircrewmen maintained good

motivation, probably because of the satisfactions obtained from flying and from other aspects of their Air Force careers
Author (TAB)

N67-11080# Bio-Dynamics, Inc., Cambridge, Mass.
DESIGN AND USE OF INFORMATION SYSTEMS FOR AUTOMATED ON-THE-JOB TRAINING. II: DESIGN OF SELF-INSTRUCTIONAL FEATURES
Thomas B. Sheridan, Benjamin C. Duggar, and Sylvia R. Mayer Jan. 1964 35 p refs
(Contract AF 19(628)-455)
(ESD-TDR-64-234; AD-602042) CFSTI: $1.00

The report is concerned with human engineering factors in the design of information systems. In particular it is addressed to the design of self-instructional features for these systems. It describes theories, methodology, and design principles for implementation of self-instructional features. The design principles were induced from the exploratory research on laboratory models of information systems which is reported in Volume I of this series (AD-602 041), from studies on current information systems, and from a literature review. The operational concepts underlying the study are stated, and an equipment design philosophy is proposed to complement this operational concept. Author (TAB)

N67-11167# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FOODS FOR COSMONAUTS
15 Jun. 1966 4 p Transl. into ENGLISH from Sov. Estoniya (USSR), 14 Nov. 1964 p 4
(FTD-HT-66-225; TT-66-62355; AD-639494) CFSTI: HC $1.00/MF $0.50

Translation of Russian article: Foods for Cosmonauts. TAB

N67-11183# Lockheed-Georgia Co., Marietta.
USE OF THE EXPERIMENTAL METHOD FOR EVALUATIONS OF PERFORMANCE IN MULTI-MAN SYSTEMS
George E. Passey, Earl A. Alluisi, and W. Dean Chiles (AMRL) Wright-Patterson AFB, Ohio, AMRL, Aug. 1966 28 p refs Presented at 7th Ann. Meeting of The Human Factors Soc., Palo Alto, Calif. 23–25 Oct. 1963. Prepared in cooperation with AMRL Previously published as AMRL Memo P-67
(Contract AF 33(657)-10506)
(AMRL-TR-66-121; P-67; AD-638183) CFSTI: HC $2.00/MF $0.50

The report decusses the use of the experimental method as a technique for arriving at solutions to human factors engineering problems encountered in the design of multi-man systems. Of specific concern are the methodological decisions that must be made in the design of the research. Factors that are likely to influence these decisions are considered as well as the implications of these decisions with respect to the validity and generality of the data thus obtained. These various decision points are illustrated through use of data on group performance during long-term confinement Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N67-10078# Reactor Group, United Kingdom Atomic Energy Authority, Culcheth (England).
PREPARATION OF CARBON-14 LABELLED GRAPHITES USING ADDITIVES IN THE MANUFACTURING PROCESS
V. Y. Labaton, M. J. Jenkins, P. Schofield, and M. F. Sheppard 1966 19 p refs
(TRG-1258(C)) HMSO: 3s

A description is given of the preparation of three types of carbon-14 labelled graphites using additives in the manufacturing process. Type I involved incorporating active carbon black with "R" coke in a preparation closely similar to that of pile grade A graphite. Type II labelled material involved adding labelled cuprene to the binder, and Type III the use of an active grist coke and active binder, both derived from labelled cuprene. The physical properties of the labelled graphites are reviewed and compared with PGA graphite. The measurement of specific activity of specimens by thermal and radiolytic procedures is described, and some discussion is given of the important aspect of homogeneity of labelling. Author

N67-10147# Polish Academy of Sciences, Warsaw. Instytut Badan Jadrowych.
THE INFLUENCE OF SURFACE-ACTIVE AGENTS ON THE EFFECT OF DECONTAMINATION [L'INFLUENCE DES AGENTS TENSIO-ACTIFS SUR L'EFFET DE LA DECONTAMINATION]
Aleksander Siemaszko May 1966 67 p refs In POLISH; FRENCH summary
(Rept.-725/XXII/C) CFSTI: HC $3.00/MF $0.75

Radioactive contamination is studied in the light of surface-active agents' influence on various materials. It was ascertained that this effect is the result of ion capture by the molecules of the detergent (adsorption on soap micelles, ion exchange, etc.). This capture, together with other interactions, considerably diminishes the adsorption. A brief evaluation of decontamination methods is included. Transl. by R.Li.

N67-10178# Pisa Univ. (Italy). Inst. of Industrial and Applied Chemistry.
LOSS OF HEAD IN ABSORPTION TUBES [PERDITE DI CARICO IN TUBI DI ASSORBIMENTO]
G. F. Nencetti, S. Zanelli, and N. Morgantini 1965 19 p refs In ITALIAN Sponsored by Consiglio Nazl. delle Ric. *Its* Ser. 23, No. 1101 CFSTI: HC $1.00/MF $0.50

Experimental results of studies on gas-liquid absorption in vertical tubes are reviewed. Emphasis is placed on heat transfer and energy loss. For improved measurement accuracy in the fluid dynamic study undertaken, a homogeneous flow model was constructed. In the hypothesis advanced, the pressure coefficient appears as a function of the Reynolds number and of the Froude number. The importance of mixing and the difficulty in extrapolating values are demonstrated. Transl. by R.Li.

N67-10180# Library of Congress, Washington, D. C. Aerospace Technology Div.
ORGANIC SEMICONDUCTORS—ANALYTICAL SURVEY Survey of Soviet Scientific and Technical Literature
Serge Markov 20 Apr. 1966 53 p refs
(ATD-66-49)

An analytical survey on the electrical properties of organic semiconductors and photoconductors is presented. Emphasis is placed on semiconducting polymers prepared from the monomers of polyvinylenes, and polynitriles. The preparation of semiconducting polymers, as well as of the polyvinylenepolynitrile copolymer is reviewed. In the annotated bibliography section the 40 entries are grouped under the headings: polyvinylenes, polynitriles, and polyvinylenepolynitriles. Material has also been included on the preparation of such products, known or potential, and their structure, morphology, and magnetic properties insofar as these are associated with electrical properties. R.U.

N67-10196*# National Aeronautics and Space Administration, Washington, D. C.

PREPARATIVE METHODS FOR ALLOYS USING SULFUR [O METODAKH SINTEZA SPLAVOV I SOYEDINENIY S UCHASTIYEM SERY]

P. G. Rustamov and B. N. Mardakhayev Jul. 1965 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Azerb. SSR (Baku), v. 20, no. 9, 1964 p 13–15

(NASA-TT-F-9487) CFSTI: HC $1.00/MF $0.50 CSCL 07B

An alternative to the conventional methods for preparing alloys and solid is offered for highly volatile components. As usual, the materials are placed in an evacuated ampule, but the furnace is at first inclined in a semihorizontal position, creating a temperature gradient that is controllable by raising or lowering the ampule in the furnace. Subsequently, the entire arrangement is righted, and the process continues according to the conventional vertical method, except that at first a difference in temperature is maintained, eventually going over to a uniform temperature. The outcome is the synthesis of more alloy in a given time with safety. By using the method described, 18 to 20 g of gallium sulfides (GaS and Ga_2S_3) was prepared in two to four hours. Author

N67-10203*# National Aeronautics and Space Administration, Washington, D. C.

THE PROBLEM OF THE VOLATILITY OF NIOBIUM OXIDES [K VOPROSU O LETUCHESTI OKISLOV NIOBIYA]

I. V. Golubtsov, A. V. Lapitskiy, and V. K. Shiryayev Jun. 1966 8 p refs Transl. into ENGLISH from Izv. Vysshykh Uchebn. Zavedenii, Khim. i Khim. Tekhnol. (Ivanova), no. 4, 1960 p 571–574 Presented at the 1st Interinst. of Higher Learning Conf. on Radiochem., Moscow, 20–25 Apr. 1959

(NASA-TT-F-10224) CFSTI: HC $1.00/MF $0.50 CSCL 07B

Investigations on the volatility of niobium oxide, by measuring the saturated vapor pressure of niobium dioxide and pentoxide, in a Knudsen effusion chamber, at 1489 to 1905° K with radioactive Nb^{95} as tracer, are discussed. Block diagrams of the modified HF-heated vacuum unit with quartz collector, and tabulated data of the measured vapor pressures of niobium oxides are given. Niobium pentoxide in air at 1350°C does not evaporate, while it undergoes thermal dissociation in vacuum above 1150°C in accordance with the equation: $Nb_2O_5 = 2\ NBO_2 + 1/2\ O_2$. Author

N67-10231*# National Aeronautics and Space Administration, Washington, D. C.

CERTAIN LAWS OF PHOTOCHEMICAL DECOMPOSITION OF OZONE IN THE LIQUID PHASE [NEKOTORYYE ZAKONOMERNOSTI FOTOKHIMICHESKOGO RAYLOZHENIYA OZONA V ZHIDKOY FAZE]

A. V. Pankratov and S. Ya. Pshezhetskiy Nov. 1966 13 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 32, no. 7, 1958 p 1605–1611

(NASA-TT-F-10388) CFSTI: HC $1.00/MF $0.50 CSCL 07D

The photochemical decomposition of ozone in the liquid phase has been investigated at −183°C. For comparison, measurements have also been made of the reaction in the gaseous phase. The quantum yield in the liquid phase −183°C, attains a value of 25; in the gaseous phase at room temperature it is about 3.5. Dilution of the liquid ozone with oxygen lowers the quantum yield. The value of the yield shows that the photochemical decomposition of ozone in the liquid phase proceeds according to a chain mechanism with the participation of exited oxygen molecules. The difference in the quantum yield values of the reaction in the liquid and gaseous phases may be explained in that in the liquid phase the conditions are evidently more favorable for the transfer of energy from the excited oxygen to the ozone molecules. Author

N67-10275# Manlabs, Inc., Cambridge, Mass.

FUNDAMENTAL STUDY OF THE SINTERING KINETICS OF REFRACTORY COMPOUND PHASES AT HIGH PRESSURE AND HIGH TEMPERATURE Final Report

Edward V. Clougherty and Lerry Kaufman Oct. 1964 21 p refs (Contract Nonr-4262(00))

(AD-637247) CFSTI: HC $1.00/MF $0.50

A novel procedure is presented by which fine-grained high-density crack-free samples of borides and carbides of metals can be fabricated without the use of additives. The required pressures are of the order of 150–300 ksi compared with pressures of 1–10 ksi as used in conventional hot pressing. To study the mechanism of densification by this procedure, a fundamental program with TiB_2 as a representative hard metal compound is developed to define the significant variables and to provide data on the kinetics of densification at high pressure. S.P.

N67-10325# Royal Inst. of Tech., Stockholm (Sweden). Physics Dept.

FORMATION OF CARBON DIOXIDE IONS AFTER ELECTRON AND ION IMPACT

H. Sjogren 15 Mar. 1966 20 p refs

(Contract AF 61(052)-762)

(AFCRL-66-605;AD-637948) CFSTI: HC $1.00/MF $0.50

The ionization of CO2 was investigated in a double mass spectrometer, and the breakdown graph was constructed. The appearance potential of O(+) formed in dissociative charge transfer is shown to be 22.4 eV, while the electron impact value is 19.5 eV. The discrepancy is explained according to Wigner-Witner correlation rules. A break in the electron impact ionization efficiency curve is explained as being due to charge exchange between CO(+) ions, formed in the dissociative charge transfer, and CO2 Author (TAB)

N67-10332# Rutgers Univ., New Brunswick, N. J. School of Chemistry.

CONTAMINATION OF SILICAS DURING HIGH TEMPERATURE DEGASSING IN VYCOR TUBES

M. J. D. Low, N. Ramasubramanian, and P. Ramamurthy 6 Sep. 1966 16 p refs

(Contract Nonr-404(19))

(TR-3; AD-638237) CFSTI: HC $1.00/MF $0.50

An infrared absorption near 3702/cm was produced if Cab-O-Sil was degassed at 800C in a Vycor cell, and then partially hydrated. The band was not produced with specimens degassed in quartz cells. A variety of experiments lend strong although indirect support to the conclusion that the band was due to surface B-OH groups brought about through the contamination of the silica surface by boron volatilized from the hot Vycor. Similar contamination can be expected to occur with all specimens heated at 800C in Vycor, but the effects of the contamination may not be readily discernible by means of infrared spectra Author (TAB)

N67-10411# Naval Ordnance Lab., White Oak, Md. Chemistry Research Dept.

REACTION OF SILICA WITH TETRAETHYL ORTHOSILICATE

James V. Duffy 28 Jul. 1966 18 p refs

(NOLTR-66-97; AD-638635) CFSTI: HC $1.00/MF $0.50

The reaction of tetraethyl orthosilicate with fumed silica at various temperatures was investigated. It was found that essentially no reaction occurred at 25C or 100C after short reaction periods. At 165C, the reaction proceeds with both hydrated and predried silica glass surfaces. It was shown that silanol sites on the glass do take part in a reaction which results in the formation of new siloxane bonds. These sites can be rehydrated after thermal degradation of the treated surfaces in vacuum Author (TAB)

N67-10453# Mellon Inst., Pittsburgh, Pa.
MELLON INSTITUTE RESEARCH Annual Report, Fiscal Year Ending Feb. 28, 1966
28 Feb. 1966 47 p refs
(AR-53)

Continuing research and professional activity are reported. The general areas of investigation include: biochemistry and molecular biology; environment and public health; structure and properties of organic and inorganic materials; polymer systems; continuum physics and viscoelasticity; nuclear magnetic resonance spectroscopy and molecular physics; quantum chemistry and mechanics; and metal physics and metallurgy. N.E.N.

N67-10486# Lexington Labs., Inc., Cambridge, Mass.
VAPOR PHASE GROWTH OF RUBY MONOCRYSTALS Semiannual Technical Summary Report No. 2, 2 Jan.–1 Jul. 1966
Philip S. Schaffer Aug. 1966 20 p refs
(Contract Nonr-4574(00)-1; ARPA Order 306; Proj. Defender)
(AD-638007) CFSTI: HC $1.00/MF $0.50

The technique of preparing large, high perfection ruby monocrystals by vapor phase growth was further investigated and developed. A device was incorporated into the system which increased control of total pressure during crystal growth. Ruby crystals were successfully grown using chromium chloride and chromium carbonyl as sources of chromium vapor. Positioning the ruby crystal such that the longitudinal axis was perpendicular rather than parallel to the impinging reactant gas stream was investigated. Oxidation potential was determined to be an important process variable affecting Cr2O3 concentration. Laser oscillation of a vapor-grown ruby compared to Verneuil and Czochralski-grown rubies showed it to be of high optical perfection. (Author) TAB

N67-10513# Space General Corp., Los Angeles, Calif. Center for Research and Education.
ON THE MECHANISM OF 2, 4-DIMETHYLENETETRABORANE FORMATION AND A SUGGESTED CLASSIFICATION FOR CARBORANES AND ALKYLBORON HYDRIDES
Robert E. Williams and F. James Gerhart 1 Sep. 1966 13 p refs Submitted for Publication
(Contract Nonr-4381(00))
(TR-9; AD-638637) CFSTI: HC $1.00/MF $0.50

C2D4B4H8 (tetradeutero-2,4-dimethylenetetraborane) is prepared from deuterethylene and tetraborane demonstrating that ethyltetraborane is not an intermediate species and that B4H10 probably yields (B4H8) which adds to C2D4 without hydrogen migration. A system of classifying boron-carbon-hydrogen compounds is suggested Author (TAB)

N67-10534# California Univ., Berkeley. Lawrence Radiation Lab.
SOLID-STATE COUNTERS FOR IMMEDIATE ANALYSIS DURING COLUMN CHEMISTRY
James T. Haley, Robert J. Walker, and Tommy R. Corbin 12 May 1966 11 p
(Contract W-7405-ENG-48)
(UCRL-16869) CFSTI: HC $1.00/MF $0.50

A reliable method, using solid-state detectors, is described for the immediate determination of actinide and lanthanide elution peak positions during separation of transplutonium elements and rare earths. Author (NSA)

N67-10536# California Univ., Berkeley. Lawrence Radiation Lab.
A SEMIAUTOMATIC INFRARED ANALYZER FOR SERUM TRIGLYCERIDES AND CHOLESTERYL ESTERS
Norman K. Freeman, Edward Lampo, and Alfred A. Windsor 18 May 1966 14 p refs
(Contract W-7405-ENG-48)
(UCRL-16880) CFSTI: HC $1.00/MF $0.50

An instrument was developed for the semiautomatic analysis of mixtures of triglycerides and cholesteryl esters. The method is based on high-resolution infrared spectrophotometry, and was previously shown to be applicable to the determination of these components in the nonionic fraction of human serum lipids. A simple non-recording grating spectrophotometer was suitably modified to carry out this analysis; and appropriate computing circuitry was coupled with it for performing the two-component calculation. The supplementary electronics consist of operational amplifiers, a logarithmic conversion circuit, a digital voltmeter, and a printer. Automatic operation is accomplished by a control mechanism, which programs the measurements, the steps in the calculations, and print-out of the results. Sample preparation consists of an extraction of lipids from serum in such a way as to exclude phospholipids. This may be done in a single step, although a two-step procedure, total lipid extraction followed by adsorption separation of the phospholipids, appears to be more reliable. Measurements were made on a solution of the neutral lipid fraction in carbon tetrachloride. Author (NSA)

N67-10538# Oak Ridge National Lab., Tenn.
DATA COLLECTION AND EVALUATION WITH AN X-RAY DIFFRACTOMETER DESIGNED FOR THE STUDY OF LIQUID STRUCTURE
H. A. Levy, M. D. Danford, and A. H. Narten Jul. 1966 61 p refs
(Contract W-7405-ENG-26)
(ORNL-3960) CFSTI: HC $3.00/MF $0.75

An X-ray diffractometer designed specifically for studies of structure in liquids is described in detail. The diffraction pattern from the horizonal surface of the liquid sample is obtained with a divergent beam technique similar to the Bragg-Brentano flat sample system used for powder samples. The instrument provides for simultaneous angular motion of the X-ray tube and the detector about a horizontal axis lying in the liquid surface. This method eliminates sample holder absorption and scattering. A small furnace for high temperature work is included in the design. Monochromatic X-radiation, essential to good work with liquids, is obtained through the use of a bent and ground crystal monochromator mounted in the diffracted beam. Data collection with this instrument, and the various correction procedures applied to the raw data are discussed in detail. The theory of X-ray diffraction by liquid systems is reviewed in the light of recent developments in this field. The derivation of reduced intensity and radial distribution functions from the diffraction data is described, and ways of obtaining meaningful information on liquid systems from these functions are outlined. Author (NSA)

N67-10544# Metaalinstituut TNO, Delft (Netherlands).
TESTING OF WARM PHOSPHATES. I: INVESTIGATION OF CRYSTALLINE UNCOATED PHOSPHATE FILMS [SPEURWERK WARM FOSFATEREN. I: DE BEPROEVING VAN KRISTALLIJNE NIET GELAKTE FOSFAATFILMS]
15 Aug. 1966 24 p refs In DUTCH
(M-66-656; TDCK-46184) CFSTI: HC $1.00/MF $0.50

Aim of this study is to survey protective phosphate and lacquer coatings for relatively small steel parts, especially for military use, and to improve application processes and effectiveness of protection. The following characteristics are discussed: (1) general exterior appearance of the coating; (2) color reactions; (3) density of coating; (4) weight of coating; (5) corrosion resistance; (6) porosity and discontinuities; and (7) surface roughness. Detailed methods for examining these characteristics are given. Included are step-by-step descriptions of sample analyses. K.W.

N67-10570# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
TRITIUM AUTORADIOGRAPHY. A TOOL FOR STUDIES OF ION ADSORPTION AND ISOTOPIC EXCHANGE

Elwira Herczynska and Krystyna Prószyńska Dec. 1965 17 p refs
(Rept.-679/V/C) CFSTI: HC $1.00/MF $0.50

The adsorpiton of H+ and OH− ions and Al and Cu surfaces was studied simultaneously by the use of pH-metric and tritium autoradiographic methods. Test methods are discussed in detail, and the autoradiographs selected for measurement are depicted. Results indicated that the autoradiography of adsorbed tritium on the surface of the metals is feasible and the results are qualitatively reproducible; it presented experimental proof that the process occurring at the interface of oxidized metals–aqueous solutions may be the adsorption of H+ and OH− ions; and a way was suggested to study the exchange protium-tritium in solutions, especially at the surfaces of metals. L.E.W.

N67-10586# United Kingdom Atomic Energy Authority, Harwell (England). Chemistry Div.
THE RADIOLYTIC REACTION BETWEEN GRAPHITE AND CARBON DIOXIDE. PART 7: THE INFLUENCE OF CARBON MONOXIDE
D. A. Dominey and H. Morley Jul. 1966 25 p refs
(AERE-R-4989) CFSTI: HC $1.00/MF $0.50

The magnitude of the effect of CO on the radiation-induced reaction between CO_2 and graphite depends critically on the geometrical arrangement of the system, the temperature and the gas pressure. When the majority of the irradiated gas is in the pores of the graphite the maximum effect occurs below a CO concentration of 0.5%. The absolute G(−C) in the complete absence of CO is uncertain because of the difficulty of extrapolation to such a condition. A simple mechanism is proposed which satisfactorily explains existing results. Author

N67-10587# Lockheed Missiles and Space Co., Palo Alto, Calif.
KINETICS OF DESORPTION OF WATER VAPOR AND CARBON DIOXIDE FROM ZEOLITES UNDER VACUUM
N. V. Kel'tsev [1966] 6 p refs Transl. into ENGLISH from Gaz. Prom. (Moscow), no. 4, 1964 p 51–54 CFSTI: HC $1.00/MF $0.50

Experiments were conducted with the zeolite granules ordinarily used in practice and obtained in the process of forming crystalline zeolite powder with 10–20% of binder (clay). Diffusion factors are computed for water and carbon dioxide, and it is shown that in desorption of water the factor of $20\cdot10^{-7}$ cm^2/sec is reached at a temperature above 150°C, and for CO_2—above 0°C. It is also pointed out that when the molecular size of the adsorbed substance is close to that of the windows giving access to the adsorption cavities of the zeolite a reduction in diffusion factor, and consequently of the desorption rate, is noted. A.G.O.

N67-10593# Joint Publications Research Service, Washington, D. C.
STUDY OF THE PRODUCTION OF HEAVY WATER IN FRANCE
B. Lefrancois, J. M. Lerat, and E. Roth 3 Nov. 1966 12 p refs Transl. into ENGLISH from Proc. of the 3rd Intern. Conf. on the Peaceful Uses of Atomic Energy, v. 12, 1965 p 382–388
(JPRS-38475; TT-66-34900) CFSTI: $1.00

Since 1958 several processes for the production of heavy water have been under study. Each was examined in reasonably complete detail, and attention was finally concentrated on isotopic exchanges between hydrogen sulfide and water, and between ammonia and synthesis gas, pilot-plant experiments having shown that the distillation of hydrogen, though technologically satisfactory, is not competitive. Research was continued on the NH_3-synthesis gas exchange process, and led to the decision to build a production unit in which the process was combined with the sythesis of ammonia. From among the various possible schemes for carrying out the process, the single-temperature system was chosen, in spite of certain technological problems, because it ensured high enrichment with a smaller number of contact devices. These have now been perfected after large-scale pilot-plant tests. The initial industrial trials, which are about to start, will supply useful information for second-generation plants, whether they keep to the single-temperature lay-out or revert to the two-temperature system. Author

N67-10602# Iowa State Univ. of Science and Technology, Ames.
SINTERING STUDY IN THE PARTIALLY VITREOUS As–S–Se SYSTEM
Michael Andrew Carrell (Ph.D. Thesis) May 1966 138 p refs
(Contract W-7405-ENG-82)
(IS-T-80) CFSTI: HC $4.00/MF $1.00

Sintering of vitreous As–S–Se compositions by the sphere–sphere technique led to interesting relationships concerning the viscous flow mechanism. Sphere–sphere-geometric models were proposed to relate surface area to the sintering rate, and one such model was used for this purpose. The slope of the logarithm of the ratio of neck radius to the initial radius plotted against the logarithm of time of sintering was found to be compositionally dependent. Three main types of internal structure are suggested in order of increasing arsenic content: a system of chains and rings with arsenic pinning points; trigonal ($As(S,Se)_3$ elements bound together by Se–Se, Se–S, and/or S–S linkages; and a dense network of entirely As–S and/or As–Se linkages. When the ratio of surface area to final surface area was plotted against time of sintering the relationship was of the form $A/A_f = -k_1t + k_2$, where A is the surface area at any elapsed time, t, A_f is the surface area finally obtained, k_1 is a constant depending on temperature, and k_2 is a constant depending on composition. This equation indicates a constant dissipation of internal energy by a flow process. Deviation from this linear relationship exists for structures involving ring and long chain configurations at viscosities above approximately $10^{7.5}$ poises, which indicates an introduction of viscoelastic properties. A linear shrinkage equation of the form $-k_1t = -2.11(\Delta L/L) + 7.317(\Delta L/L)^2 - 13.075(\Delta L/L)^3$ was obtained for compositions whose slopes of logarithm of the ratio of neck radius to the initial radius plotted against the logarithm of time of sintering were greater than 0.5; where L is the initial length of the two spheres, $4R_i$; ΔL is the linear shrinkage at any elapsed time, t; and k_i is is the linear shrinkage at any elapsed time, t; and k_i is a constant depending on the temperature. Author (NSA)

N67-10621# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
THERMOCHEMICAL ANALYSIS OF VAPOR PLATING PROCESSES
J. D. Fleming, W. C. Robinson, and C. F. Leitten, Jr. Jul. 1966 28 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1454) CFSTI: HC $2.00/MF $0.50

The thermochemical vapor deposition (CVD) process involves diffusion, adsorption, desorption, and chemical reaction, all of which are influenced by temperature, pressure, and gas composition. The complexity of the process makes a purely experimental study inadequate. Thermochemical calculations cannot be applied rigorously to most CVD systems but can be used to direct experimental work. The advantages and application of thermochemical calculations are discussed, and the basic equations used for determining parameters in CVD processes are presented. The calculation procedure and the type of data obtained from this type of procedure are illustrated by two examples, which were chosen from systems previously considered and developed at ORNL. An organized logical procedure for performing the pre-experimental screening of proposed systems is presented and the method used to interpret data for use in further experimental study is described. NSA

N67-10823# Hebrew Univ., Jerusalem (Israel). Dept. of Physical Chemistry.
SENSITIZED RADIOLYTIC ISOMERIZATION OF STILBENE
Ernst Fischer, H. P. Lehmann (Weizmann Inst. of Sci.), and Gabriel Stein [1965] 7 p refs
(Contract AT(30-1)-3242)
(NYO-3242-13) CFSTI: HC $1.00/MF $0.50

The effects of gamma radiation and X-radiation on cisstilbene and trans-stilbene in benzene were investigated. The isomeric compositions of irradiated samples were analyzed spectrophotometrically. Data are also included on the effects of air, anthracene, naphthalene, and biacetyl on the radioinduced reactions. NSA

N67-10634# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.
A LITERATURE REVIEW OF MASS SPECTROMETRIC-THERMOCHEMICAL TECHNIQUE, SUPPLEMENT I
J. D. Redman Jul. 1966 41 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-989, Suppl. I) CFSTI: HC $2.00/MF $0.50

Bibliographies are presented on thermochemical properties of gaseous species by mass spectrometry, techniques and instrumentation applicable to thermochemical mass spectrometry, and thermodynamic properties of Be and alkali metal halides. NSA

N67-10639# Commissariat a l'Energie Atomique, Saclay (France). Departement de Physico-Chemie.
ADSORPTION STUDIES IN A FLUORINATING ATMOSPHERE [ETUDE DE L'ADSORPTION EN ATMOSPHERE FLUORANTE]
Jean-Jack Abassin, Paul Barberi, Yves Guillouet, Olivier Hartmanshenn, Jacques Lambard et al Mar. 1966 78 p In FRENCH
(CEA-R-2932)

Aspects of the adaptation of conventional or non-conventional apparatus to the measurement of the physical and chemical adsorption of corrosive fluorine-containing gases are reviewed. Discussions are included on thermogravimetry, volumetry, use of radioactive tracers, calorimetry, hertzian spectroscopy, and infrared spectroscopy. In each of these cases, problems of corrosion call for the use of special techniques which require the extensive use of pure Ni and Al or their alloys. Diagrams of the apparatus and some examples of applications are given, together with some details of the performances. Author (NSA)

N67-10643# Syracuse Univ., N. Y.
THE CALCIUM–LITHIUM EQUILIBRIUM SYSTEM
Daniel G. Carfagno (Ph.D. Thesis) Jun. 1966 98 p refs
(Contract AT(30-1)-1910)
(NYO-2731-7) CFSTI: HC $3.00/MF $0.75

The calcium–lithium equilibrium system was investigated over the complete range of compositions by thermal analysis, differential thermal analysis, and X-ray methods. The solid solubility of calcium in lithium was very small and reached a maximum of 0.4 at.% at the eutectic temperature. A eutectic occurred at 8.2 at.% calcium. The eutectic temperature was 141°C and extended over the composition range 0.4 to 33.3 at.% calcium. Only one compound, $CaLi_2$, existed in this system. It was formed through a peritectic reaction at 230°C, which occurred over the composition range 30 to 90 at.% calcium. $CaLi_2$ was found to crystallize in a hexagonal close packed structure with unit cell dimensions $a_0=b_0=6.313$ Å and $c_0=10.28$ Å. The density of $CaLi_2$ was determined by the flotation method to be 1.016 g/cm^3, requiring four molecules of $CaLi_2$ per unit cell. The space group was determined from Weissenberg equi-inclination photographs to be $D^4_{6h}=P_{63}/mmc$. Interatomic distances were calculated from the atom locations. Terminal solid solutions corresponding to the three allotropic modifications observed in pure calcium were generated by peritectic reactions: at 370°C, liquid + γ(hcp) $\leftrightarrow$ β(fcc) over the range 56.3 to 93 at.% calcium; and at 688°C, liquid + δ(bcc) $\rightarrow\gamma$(hcp) over the range 85.5 to 94 at.% calcium. A specially prepared high-purity sample of calcium yielded conflicting results regarding its allotropy. Author (NSA)

N67-10682# Iowa State Univ. of Science and Technology, Ames.
CRYSTAL STRUCTURE STUDIES OF SOME UNUSUAL ANTIMONY BROMIDE SALTS
Stephen Latham Lawton (M.S. Thesis) May 1966 144 p refs
(Contract W -7405-ENG-82)
(IS-T-89) CFSTI: HC $4.00/MF $1.00

Jet black salts of the type $R_xSb_yBr_z$ were prepared to obtain information about the oxidation state(s) of antimony within them, the stereochemistry of the $SbBr_6^{n-}$ anions, and structural features associated with the charge transfer process. All cations used were monovalent, such as the ammonium ion, the quaternary ammonium ion and saturated and unsaturated protonated heterocyclic amines. Preliminary studies revealed that the cation has a strong influence on the ratio R:Sb: Br, its crystal structure, the stability of the salt with increasing temperature, and the color of the salt with decreasing temperature. Several of the salts become bright orange to red at or near liquid nitrogen temperature. The detailed crystal structures of two of these salts, $(NH_4)_4Sb^{III}Sb^{V}Br_{12}$ and $(C_5H_5NH)_6Sb^{III}Sb_3{}^{V}Br_{24}$, were solved by single crystal X-ray diffraction techniques. The final results of both determinations confirmed the presence of trivalent and pentavalent antimony rather than tetravalent antimony. The ammonium salt is a distorted K_2PtCl_6 structure with like-oxidation states of antimony repeating along the a- and b-directions of the tetragonal unit cell but alternating along the c-direction. It contains undistorted $Sb^{III}Br_6^{3-}$ ions (with O_h symmetry) and distorted $Sb^{V}Br_6$– ions (with D_{2d} symmetry). The pyridinium salt consists of $Sb^{III}Br_6^{3-}$ ions (with C_s symmetry) and two crystallographically independent $Sb^{V}Br_6$– ions (with C_s and Cy symmetry). The anions form two types of non-intersecting, approximately linear chains, one involving Sb(V) only and the other alternating Sb(III)-Sb(V) anions. Author (NSA)

N67-10685# Atomic Power Development Associates, Inc., Detroit, Mich.
THE DETERMINATION OF HYDROGEN IN SODIUM METAL
S. A. Meacham and E. F. Hill Jun. 1966 38 p refs
(Contract AT(11-1)-865)
(APDA-183) CFSTI: HC $2.00/MF $0.50

A method for differential determination of hydrogen in sodium from sodium hydroxide and hydrogen from sodium hydride and/or dissolved hydrogen is defined. The procedure utilizes a two-stage vacuum-reflux technique employing mercury as the refluxing medium; the hydrogen evolved is quantitatively measured by gas chromatography. By carefully controlling the amalgamation temperature, hydroxide hydrogen, nonhydroxide hydrogen, and total hydrogen can be determined. The recommended procedure is applicable to the determination of 0.2 to 100 μg of hydrogen in sodium with a relative standard deviation of $\pm$5%. The hydrogen thus determined can be hydroxide, nonhydroxide, or total hydrogen. Author (NSA)

N67-10691# Atomic Weapons Research Establishment, Aldermaston (England).
THE THERMAL STABILITY OF METAL HYDRIDES. PART 2: SAMARIUM AND GADOLINIUM HYDRIDES
P. M. S. Jones, P. Ellis, and T. Aslett May 1966 24 p refs
(AWRE-O-31/66) HMSO: 3s 6d

The plateau dissociation pressures of SmH_2 and GdH_2 were found to follow the equations. Sm: $\log_{10} P_{mm} = 8.616 \pm 0.040 - (9.393 \pm 0.120) \times 10^3/T°K$. Gd: $\log_{10} P_{mm} = 9.426 \pm 0.139 - (9.871 \pm 0.028) \times 10^3/T°K$. Calculated lattice energies of the rare earth series are included and the factors affecting the heats and entropies of formation discussed. Author (NSA)

N67-10716# Iowa State Univ. of Science and Technology, Ames.
EFFECTS OF ELECTRON CORRELATION IN X-RAY DIFFRACTION AND AN ELECTRON DIFFRACTION STUDY OF XeF_6
Robert Michael Gavin, Jr. (Ph.D. Thesis) May 1966 98 p refs
(Contract W-7405-ENG-82)
(IS-T-93) CFSTI: HC $3.00/MF $0.75

The theory of X-ray diffraction by gas atoms was examined from the standpoint of one- and two-electron operators. Electron–nuclear D(r) and electron–electron P(r) radial distribution functions for some simple systems were investigated. A comparison of distributions calculated from both correlated and uncorrelated wave functions indicated that P(r) functions are sensitive to the inclusion of electron correlation in the wave function, whereas D(r) functions are not. As a consequence, the total scattered intensity I_{tot}, which is related to P(r), is sensitive to effects of electron correlation whereas the elastic intensity, which is related to D(r), is not. For helium-like systems, the shifts in P(r) and I_{tot} due to electron correlation follow a regular trend with atomic number. A simple scheme for predicting these correlation shifts for more complex atoms was derived from the trends noted. Correlation shifts in P(r) and I_{tot} for the beryllium atom were predicted and the results compared with shifts calculated from correlated and uncorrelated wave functions. Agreement between predicted and calculated shifts was reasonably good. Radial distribution functions P(r) for neon and argon were derived from experimental X-ray intensities. The resulting distribution functions were used to calculate electron–electron potential energy values, V_{ij}. The V_{ij} for neon and argon calculated from the experimental data are 1.12 and 1.40 a.u., respectively. Corresponding values of 1.20 and 1.36 a.u. were obtained from Hartree–Fock wave functions. The P(r) functions compared favorably with those calculated from existing wave functions but experimental uncertainties were large enough to obscure effects of electron correlation. The structure of XeF_6 was investigated utilizing the sector-microphotometer method of electron diffraction. Results of the study indicated that the molecule is not a regular octahedron. The mean XeF bond length was 1.887 ± 0.005 Å and the mean amplitude of vibration was 0.070 ± 0.020 Å. The nature of the distortion from O_h symmetry is described. The fluorines on one side of the molecule are pushed apart and this deformation compresses the fluorines together toward the other side of the molecule. Three models, with symmetries C_{3v}, C_{2v}, and C_s, containing distortions of this form provide acceptable fits of the experimental data. Author (NSA)

N67-10724# Brookhaven National Lab., Upton, N. Y.
STATUS OF GAMMA IRRADIATOR DESIGN
Bernard Manowitz Apr. 1966 39 p Presented at the Am. Inst. of Chem. Engr. Meeting, Atlantic City
(Contract AT(30-2)-GEN-16)
(BNL-10257; CONF-660903-1) CFSTI: HC $2.00/MF $0.50

The status of gamma irradiator design for the destruction of bacteria and insects and for the initiation of chemical reactions is reported. NSA

N67-10732# Oak Ridge National Lab., Tenn.
OXIDATION AND CHLORINATION OF UO_2-PuO_2
K. S. Warren and L. M. Ferris Jun. 1966 29 p refs
(Contract W-7405-ENG-26)
(ORNL-3977) CFSTI: HC $2.00/MF $0.50

Oxidation and chlorination of UO_2-PuO_2 was studied on a laboratory scale. High-density pellets of UO_2-PuO_2 that contained less than 20% PuO_2 usually could be converted to U_3O_8-PuO_2 powder by reaction with O_2 at 600°C. The UO_2 in pellets containing 20% or more PuO_2 could be partially oxidized; however, oxidation was always incomplete even on extended exposure to O_2 at 800°C. No powdering of the high-PuO_2-content pellets was observed. After experimentation, 85% Cl_2-15% CCl_4 was selected as a chlorinating agent. At 450 to 550°C, the rates of conversion of uranium oxides to volatile chlorides (UCl_5 and UCl_6) were about the same for small, high-density UO_2-PuO_2 pellets containing 5% PuO_2 or less as those obtained with U_3O_8-PuO_2 powders produced by oxidizing pellets. U from pellets of higher PuO_2 content was chlorinated less readily; U chlorination efficiency was unaffected by changes in PuO_2 content (0 to 20%) of U_3O_8-PuO_2 powders. At 550°C, complete conversion of U_3O_8 to volatile chlorides required 3 to 5 hr in an excess of chlorinating agent. Liquid oxychlorides formed at temperatures above about 550°C. The amount of PuO_2 converted to volatile $PuCl_4$ was proportional to the amount of Cl_2 passed through the system. This behavior was predictable from the equilibrium constant for the reaction $PuCl_{3(s)} + 1/2Cl_2 \rightleftharpoons PuCl_{4(g)}$. Large amounts of Cl_2 were required to volatilize Pu. At 500 to 600°C, about 10^4 moles (about 10^5 liters) of Cl_2 were required to volatilize one mole of $PuCl_4$. It was concluded that chloride volatility processes for recovering U and Pu from nuclear reactor fuels are not technically attractive. Author (NSA)

N67-10734# Instituto de Energia Atomica, Sao Paulo (Brazil).
APPLICATION OF ION EXCHANGE RESINS TO THE SEPARATION OF CARRIER-FREE FISSION PRODUCTS
Alcidio Abrao, M. J. Nastasi, and Afmir A. Laranja Aug. 1965 20 p refs
(IEA-101)

A radiochemical procedure for separation of radioisotopes with medium and long half lives is described. The procedure was designed for recovery of carrier-free fission products in irradiated uranium. The radioisotopes ^{137}Cs, ^{89}Sr, ^{90}Sr, and the rare earths were separated with a cationic resin, while ^{95}Zr, ^{95}Nb, and ^{103}Ru, ^{106}Ru were sequentially separated using an anionic resin. Pellets of U_3O_8 were irradiated with neutron for 15 or 200 hours and cooling times of 8 months or more were allowed. The pellets were dissolved in nitric acid and the uranium was extracted with TBP–CCl_4. Oxalic acid was added to the rafinate and then the mixture was distilled to approximately 5 ml. The residue was dissolved in 0.1M HCl and the acidity adjusted to 0.4M in oxalic acid. The fission product mixture was passed through a Dowex 50-X8, H-form cationic resin, where ^{137}Cs, ^{89}Sr, ^{90}Sr, and the rare earths ^{141}Ce, ^{144}Ce, ^{144}Pr, ^{90}Y, ^{91}Y, and ^{147}Pm were sorbed. The column was washed with 0.4M $H_2C_2O_4$–0.1M HCl and then ^{137}Cs, ^{89}Sr and ^{90}Sr, and the rare earth elements were eluted with hydrochloric acid of 1.0, 1.5 and 6.0M, respectively. The cationic column effluent, containing ^{95}Zr, ^{95}Nb, ^{103}Ru, and ^{106}Ru was percolated in a Dowex 2-X8 anionic column previously conditioned with oxalic acid. ^{95}Zr and ^{95}Nb were eluted with 1.0M HCl–0.01M $H_2C_2O_4$ and finally ^{103}Ru, and ^{106}Ru were eluted with 3.0M HNO_3. The radiochemical purity was verified by gamma spectrometry. Author (NSA)

N67-10772# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
THERMAL DECOMPOSITION OF PLUTONIUM PEROXIDE
J. D. Moseley and H. N. Robinson Jun. 1966 10 p refs Presented at Am. Nucl. Phys. Soc. Meeting, Denver
(Contract AT(29-1)-1106)
(CONF-660606-12) CFSTI: HC $1.00/MF $0.50

Experiments are described on thermal decomposition and conversion to oxide of plutonium peroxide. Conditions required to produce dry oxide reactive to hydrofluorination were investigated. Thermogravimetric analyses were used in the study. Optimum conditions were found for precipitation of plutonium peroxide from plutonium nitrate in a crystalline form that converts to PuO_2 at 300°C. NSA

N67-10777# Commissariat a l'Energie Atomique, Grenoble (France). Section de Métallurgie.
SPECTROGRAPHIC DETERMINATION OF SILICON IN URANIUM–CARBON–SILICON ALLOYS [LE DOSAGE SPECTROGRAPHIQUE DU SILICIUM DANS LES ALLIAGES URANIUM–CARBONE–SILICIUM]
Jean-Pierre Spitz, Jean-Jacques Chazee, Danh Tran Van, and Francois Desorges Apr. 1966 11 p refs In FRENCH *Its* Rept. Met. 34–65
(CEA-R-2966)

The use of spark excitation under controlled Ar atmosphere enables the spectrographic determination of Si in U–C–Si alloys. A method is presented that is rapid and accurate. Author (NSA)

N67-10781*# Notre Dame Univ., Ind. Dept. of Chemistry.
FUNDAMENTAL STUDIES ON THE SYNTHESIS OF HEAT-RESISTANT POLYMERS
G. F. D'Alelio Sep. 1966 55 p refs
(Grant NsG-339)
(NASA-CR-79593) CFSTI: HC $3.00/MF $0.50 CSC L 07C

Some kinetic parameters concerning the decomposition of the yellow, low molecular weight polyazines and the black, higher molecular weight azine polymers were investigated. Thermogravimetric analysis (TGA) and differential thermal analysis (DTA) techniques were used. This method yields the order of reaction and the energy of activation from examination of the weight loss TGA traces of the decomposing polymer. A supplemental method which yields approximate energies of activation from TGA plots, was also employed. A direct one-step synthesis of a high molecular weight black polyazine which uses only simple constituent compounds was demonstrated and shown to be feasible. Studies were initiated to attempt to determine molecular weights of black azine melt polymers by the method of end-group tagging with a characterizable moiety and subsequent elemental analysis for the presence of that group. Author

N67-10782*# Notre Dame Univ., Ind. Dept. of Chemistry.
FUNDAMENTAL STUDIES ON THE SYNTHESIS OF HEAT-RESISTANT POLYMERS Summary Report No. 12, 31 Jan.–15 Sep. 1966
G. F. D'Alelio Sep. 1966 23 p refs
(Grant NsG-339)
(NASA-CR-79592; Rept.-12) CFSTI: HC $1.00/MF $0.50 CSC L 07C

Black polymeric Schiff bases, which pass through a fusible stage, have been prepared directly by reacting aryldiamines and aryldialdehydes in benzalaniline or in a mixture of aniline and benzaldehyde. The four isomeric polymers, the meta-meta-, the meta-para-, the para-meta- and the para-para-xylylidenephenylenediamine polymers have been prepared by these direct methods from the appropriate pairs of meta- and para-phenylenediamines and phenylenedialdehydes. The thermogravimetric analyses of these polymers compare very favorably with those of the polymers prepared by the bis-Schiff base exchange method. Author

N67-10800*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RECOMBINATION OF CARBON MONOXIDE AND ATOMIC OXYGEN AT HIGH TEMPERATURES
Theodore A. Brabbs and Frank E. Belles Washington, NASA, Nov. 1966 18 p refs
(NASA-TN-3744) CFSTI: HC $1.00/MF $0.50 CSC L 07B

The technique used was found to be a simple and valuable means of studying high-temperature recombinations. Measurements of incident shock velocity and of pressure in the reflected zone, combined with relatively simple calculations of chemical equilibria, sufficed to determine quite accurately the initial conditions before expansion. Rate constants were derived from measurements of the intensity of carbon monoxide flame-band emission, which is proportional to the product of carbon monoxide and atomic oxygen concentrations. A three-body mechanism of recombination was assumed, and the results were consistent with this assumption. The rate constants for recombination had an average lower limit of 2×10^{13} centimeter^6 mole^{-2} second^{-1} and an estimated upper limit of about 1×10^{14} centimeter^6 mole^{-2} second^{-1} over the range of the experiments. These values are in the range of recombination constants derived from equilibrium constants and dissociation rates of carbon dioxide measured behind shock waves. The recombination rates found in the present work were lower than expected on the basis of previous direct measurements made at lower temperatures. It is suggested that surface and water catalysis may have combined to produce these discrepancies. Author

N67-10811# Iowa State Univ. of Science and Technology, Ames.
CONDENSED PHASE AND VAPORIZATION EQUILIBRIA IN VANADIUM (II) HALIDE-IODINE SYSTEMS
Keith Oran Berry (Ph.D. Thesis) May 1966 102 p refs
(Contract W-7405-ENG-82)
(IS-T-41) CFSTI: HC $4.00/MF $0.75

Both preparative and vapor pressure investigations of the vanadium iodide system were made. Several different types of experiments were used in an attempt to prepare and isolate VI_3. They included: chemical transport reactions, equilibration experiments between VI_2 and liquid iodine, solvent extraction using liquid iodine for the solvent and direct combination of the metal (as foil) and iodine liquid. Equilibration experiments between VI_2 and liquid iodine produced compounds whose composition ranged from $VI_{2.00}$ to $VI_{2.63}$ in the temperature range from 495 to 722°C. Although VI_2 was found to have different lattice constants than any nonstoichiometric compound, all compounds within that phase range ($2.02<I/V<2.63$) had nearly the same lattice constants. Considering the nonstoichiometric phase to be a solid solution, equilibrium constants and associated thermodynamic data were calculated. The transpiration technique was used to study the reaction between vanadium(II) iodide and iodine vapor. The principal product was determined to be VI_4. The pressure of VI_4 resulting from this reaction was determined for the temperature range from 581 to 713°K. Equilibrium constants and associated thermodynamic data were calculated. The dissociation of the nonstoichiometric iodide was investigated using the diaphragm gage technique. A linear portion of that curve was abstracted and thermodynamic calculations made for the data within the temperature range from 388 to 546°K. The vaporization or equilibrium data obtained in this investigation may be expressed as $\log P \text{ (or } K) = -A/T + B$ for the following processes: $VI_2(s) + I_2(g) = VI_4(g)$; $VI_2(soln.) + 1/2 I_2(l) = VI_3(soln.)$; and $VI_{2+x}(s) = VI_2(s) + I_2(g)$. The values obtained for A and B, along with the temperature range and data are given. Author (NSA)

N67-10812# Iowa State Univ. of Science and Technology, Ames.
SEPARATION AND DETERMINATION OF TRACE METAL IMPURITIES IN RARE-EARTH-OXIDES
Richard Kenneth Hansen (M.S. Thesis) May 1966 57 p refs
(Contract W-7405-ENG-82)
(IS-T-88) CFSTI: HC $3.00/MF $0.50

The separation and determination of certain trace metal impurities in some rare earth oxides was investigated. Within the

degree of precision and accuracy shown by the data, nickel, copper, and magnesium were determined in the sesquioxides of gadolinium, dysprosium, holmium, erbium, lutetium, and in terbium oxide (Tb_4O_7). Low results were obtained for the determination of calcium and chromium. Possible causes for the low results were discussed. The apparent cause for low chromium results was overcome. Separation was necessary to obtain accurate results for nickel. Separation of the matrix rare earth from impurities was done by retaining the rare earth on a reversed-phase partition chromatographic column employing methylenebis(di-n-hexylphosphine oxide) on Kel-F as stationary phase and 1M nitric acid as eluent. Determination of the impurities was accomplished by atomic absorption spectrophotometry. The column was rejuvenated by eluting the rare earth with 0.5M hydrochloric acid and returning the column to 1M nitric acid media. Author (NSA)

N67-10816# Academia R. P. R., Bucharest. Inst. of Atomic Physics.

GAMMA-RAY SPECTRA FOLLOWING THE DECAY OF ^{86}Br, ^{87}Br AND ^{88}Br

V. Cojocaru and M. Nachman 1966 11 p refs

(IFA-NR-24)

The gamma spectra of 1 min $^{86}Br+^{87}Br$ and 15.5 sec ^{88}Br were investigated with a scintaillation spectrometer. Gamma rays with energies of 0.22, 0.45, 0.61, 0.73, 0.84, 0.94, 1.27, 1.54 MeV and 0.026, 0.075, 0.111, 0.175, 0.216, 0.287, 0.320, 0.390, 0.528, 0.785, 1.09 MeV were found for $^{86}Br+^{87}Br$ and ^{88}Br, respectively. Their relative abundances were measured. Author (NSA)

N67-10817# European Atomic Energy Community, Ispra (Italy).

DETERMINATION OF CHLORINE AND SULFUR IN TERPHENYLS BY CHEMICAL ANALYSIS [DETERMINAZIONE PER VIA CHIMICA DI TRACCE DI CLORO E DI ZOLFO NEI TERFENILI]

G. Serrini and R. Wehking 1966 26 p refs In ITALIAN

(EUR-2952.i)

The determination of chlorine and sulfur in terphenyls by chemical analysis is described. For the determination of chlorine two different combustion methods were employed, the calorimetric bomb and the H_2–O_2 burner. Cl^- was determined by spectrophotometry. The detection limit is 2 ppM for the first method and 0.7 ppM for the second method. The coefficient of variation for both methods is about 10% at level of 10 ppM. For sulfur determination the following methods were examined: combustion by H_2–O_2 burner and spectrophotometric determination of the SO_4^{2-} obtained; and reduction of reducible sulfur by Raney-Nickel and titration of H_2S. For the first method the detection limit is 1.8 ppM and the coefficient of variation is less than 5% for levels from 20 to 60 ppM. The Raney-Nickel method detection limit reported is about 1 ppM with a coefficient of variation of 6.1 and 3.5% for levels of 54.6 and 1.2 ppM S. This method was also used for analysis of terphenyl containing large concentrations of high boilers. The results obtained are in good agreement with those found by other analytical techniques. Author (NSA)

N67-10823# Ceskoslovenska Akademie Ved, Rez. Inst. of Nuclear Research.

THE HYDROGEN FORMATION IN THE RADIOLYSIS OF LIQUID METHANOL

J. Teply and A. Habersbergerova May 1966 17 p refs

(UJV-1553)

Expressions for the kinetics of the scavenging of different precursors of hydrogen formed in the radiolysis of liquid methanol and ethanol are given. The average yield valued for different precursors of hydrogen are solvated electrons ($G_{e_s^-}=1.1$), hydrogen atoms ($G_H=1.6$–2.7) and "unscavengeable" hydrogen ($G_{H_2}=1.6$), which consists of hot hydrogen atoms or highly excited methanol molecules ($G_{H^*}\geq 1$) and of molecularly formed hydrogen ($G_{H_2,m}=0.4$–0.6). At high scavenger concentration additional electrons (not solvated) are scavenged ($G_{e^-,add}=0.5$–0.8). The known differences in the hydrogen yields in pure methanol ($G(H_2)_0=4.3$–5.4) are interpreted as caused by suppression of hydrogen atoms formation by an impurity. Similarly, in the ethanol radiolysis $G_{e_s^-}=1.0$, $G_H=2.6$, $G_{H_2}=1.2$ and $G_{e^-,add.}=0.75$. The values of rate constants were derived. It was shown that $FeCl_3$ is not an appropriate scavenger in protogenic solvents. Author (NSA)

N67-10829# Oak Ridge National Lab., Tenn.

THE SOLUBILITIES OF HF AND DF IN MOLTEN FLUORIDES

Paul E. Field (Va. Polytech. Inst.) and James H. Shaffer [1966] 17 p refs Presented at the 152d Natl. Meeting of The Am. Chem. Soc., New York, Sep. 1966

(Contract W-7405-ENG-26)

(ORNL-P-2202; CONF-660907-1) CFSTI: HC $1.00/MF $0.50

The solubilities of HF and DF in molten LiF–BeF_2 (66 to 34 mole %) were determined over the temperature range from 500 to 700°C and at solute gas pressures between 1 and 2 atm. Using previously established experimental methods, the solubilities of both gases were found to obey Henry's Law. The Henry's Law constants, $K_H(10^{-4}$ moles HF/mole melt-atm) for HF and DF respectively at 500, 600, and 700°C were: 3.37 ± 0.13, 2.96 ± 0.07; 2.16 ± 0.05, 1.83 ± 0.03; and 1.51 ± 0.06, 1.25 ± 0.03; where the values given were obtained by a linear least squares fit of the experimental data as in K_H vs $1/T$ and the uncertainties are at the 95% confidence interval. The heats of solution, ΔH^s, obtained from the least squares evaluation were -5.98 ± 0.19 and -6.43 ± 0.15 kcal/mole for HF and DF, respectively. Comparison of ΔH^s for HF in this melt composition with those obtained previously in melts ranging from 54 to 89 mole % LiF in BeF_2 revealed linear dependence of ΔH^s on the mole fraction of LiF above and below 67% with a maximum at 67% LiF. Interpretation of the isotope effect was made by comparison of the difference in the entropies of solution between DF and HF with the difference in the calculated values of the entropies of the two gases at 600°C. Author (NSA)

N67-10832# Oak Ridge National Lab., Tenn.

INVESTIGATION OF DENITRATION OF HIGH-NITRATE PLUTONIA SOLS BY BAKING

M. H. Lloyd and Eugene J. Kosiancic 22 Jun. 1966 16 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-1558) CFSTI: HC $1.00/MF $0.50

The denitration of high-nitrate plutonium(IV) polymer sols by baking to produce low-nitrate plutonia sols was investigated. A plutonia sol with a nitrate to plutonium ratio as low as 0.4 was obtained, and extrapolation of the data indicate that lower ratios should be obtained by further baking. Two temperatures were investigated and in both cases a linear plot of the data was obtained by assuming the reaction was second order with respect to residual nitrate concentration. Experimental rate constants were determined from the plots. Additional data are required to determine if the rate remains constant when baking to lower nitrate values. Author (NSA)

N67-10833# Yale Univ., New Haven, Conn. Hammond Lab.

BINARY PHASE DIAGRAMS OF HALIDE SALTS. VOLUME I

William D. Robertson 13 Jun. 1966 333 p refs

(Contract AT(30-1)-2723)

(YALE-2723-1, Vol. I) CFSTI: HC $7.00/MF $1.50

A compilation of available information on phase diagrams of halide salts is presented. A summary of information contained in 690 papers published from 1900 to 1964 is given in 337 binary phase diagrams. The scope is confined to the binary halide systems having either a common cation or common anion. All combinations of fluorides, chlorides, bromides, and iodides of metallic cations in Periodic Groups IA, IIA, IIIA, IVA, VA, and IB and IIB for which information is available on at least one phase boundary are included. All systems and tabulated data are arranged in alphabetical order of the conventional chemical notation. NSA

N67-10834# Yale Univ., New Haven, Conn. Hammond Lab.
BINARY PHASE DIAGRAMS OF HALIDE SALTS, VOLUME II
William D. Robertson 13 Jun. 1966 344 p refs
(Contract AT(30-1)-2723)
(YALE-2723-1, Vol. II) CFSTI: HC $7.00/MF $1.75

Temperature-composition diagrams are presented for numerous binary phase systems of binary halide salts. Solidus and liquidus boundaries, eutectic points, and other pertinent information regarding the system phase properties are illustrated. A.G.O.

N67-10847# Northwestern Univ., Evanston, Ill. Dept. of Chemistry.
THE ULTRAVIOLET SPECTROSCOPY OF IRRADIATED POLYETHYLENE, PART II
Malcolm Dole and G. G. A. Boehm 7 Jul. 1966 27 p refs
Presented at 3d Intern. Congr. on Radiation Res., Cortina, Italy
(Contract AT(11-1)-1088)
(COO-1088-21; CONF-660614-3) CFSTI: HC $2.00/MF $0.75

Electron irradiation of polyethylene at liquid N_2 temperatures using a combined irradiation and uv spectrophotometric cell is described. Design of the cell is discussed, along with classification of the uv absorption bands and effects of conjugated double bonds. The effects of heat and light on radioinduced free radicals are also examined. NSA

N67-10878*# Stanford Univ., Calif. Solid-State Electronics Labs.
FUNDAMENTAL STUDIES OF THE METALLURGICAL ELECTRIC, AND OPTICAL PROPERTIES OF GALLIUM PHOSPHIDE Quarterly Progress Report, Jul.1–Sep. 30, 1966
30 Sep. 1966 33 p refs
(Grant NsG-555)
(NASA-CR-79722) CFSTI: HC $2.00/MF $0.50 CSCL 07B

Continuing investigations of the transition group elements in GaP are reported. The absorption spectra of iron in some II-VI compounds are analyzed, and the energy levels of the ground state d^6 configuration are tabulated. The optical spectra of divalent iron in ZnSe, ZnTe, and CdTe are considered. It is concluded that the spectra of divalent iron in II-VI compounds can be explained on the basis of low-field crystal field theory. Results of several diffusion runs of iron into polycrystalline GaP are also reported. Studies of the preparation and characterization of rectifying junctions in GaP and $GaAs_xP_{1-x}$ focused on relating the structure of the crystals to electrical properties of the junctions. Planar crystal imperfections were characterized by etching, birefringence, and the Lang method of X-ray topography. S.P.

N67-10882*# Denver Univ. Colo.
A STUDY OF THE STRUCTURE OF THE TRANSITION METAL HYDRYLS Final Report
Charles B. Magee and Josef J. Schmidt-Collerus Oct. 1966 15 p refs
(Grant NsG-518)
(NASA-CR-79747; DRI-2357) CFSTI: HC $1.00/MF $0.50 CSCL 07B

The purpose of this program was to determine the crystal and molecular structures of the transition metal hydryls, principally the rhodium hydryls of formulae: $(LiH)_4$ Rh and $(LiH)_4$ RhH. Many attempts were made to observe the infrared absorption spectra of these and other hydryl compound using the mull technique. An evaporation technique was developed for obtaining thin films of materials on KBr plates for infrared analysis. This technique proved to be very successful for LiH and LiD, but, when applied to the hydryls, decomposition took place during evaporation and the films were not representative of the original compounds. Single crystal X-ray diffraction analysis has resulted in the unambiguous determination of the unit cell type and size of $(LiH)_4$ Rh. The cell is body centered tetragonal with $a_0 = b_0 = 6.36A°$ and $C_0 = 4.09A°$. The volume of this cell is 1.65×10^{-22}cc, and the theoretical density, based on two $(LiH)_4$ Rh molecules per cell, is 2.71 gms per cc. Author

N67-10916# Bonn Univ. (West Germany).
RADIOCHEMICAL CYCLOMERIZATION. COMPARATIVE STUDY WITH OPTICAL AND IONIZING RADIATION [STRAHLENCHEMISCHE CYCLOMERISATIONEN. EINE VERGLEICHENDE UNTERSUCHUNG MIT OPTISCHEN UND IONISIERENDEN STRAHLEN]
Wolfgang Metzner (Ph.D. Thesis) 1966 130 p refs In GERMAN
(NP-16150)

A comparative study was made of the photo- and radio-induced cyclomerization of C_4 compounds. The behavior of benzocyclic olefins such as indene and coumarin and their derivatives were investigated under conditions of photon and radiation sensitization. The photochemical and radiochemical C_4 cyclodimerization co-C_4-cyclo additions and C_4 cycloisomerization of Diels-Alder adducts of p-benzoquinone to 1,3-diene were investigated. The mechanisms of photosensitized C_4 cyclo addition, radiation-chemical formation of cyclobutanes, and formation of 1,3-dienes from chlorocyclobutanes are discussed. NSA

N67-10943# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
THE EFFECT OF CHEMICAL REACTIONS ON DIFFUSION-CONVECTIVE ENERGY TRANSFER. I: LAMINAR-DIFFUSION BOUNDARY LAYER IN THE PRESENCE OF A HETEROGENEOUS REACTION ON A CATALYTIC WEDGE-SHAPED SURFACE
V. I. Makaryavichyus and M. M. Tamonis 3 Aug. 1966 20 p refs Transl. into ENGLISH from Tr. Akad. Nauk Litovskoi SSR, Ser. B (Vilna), no. 4, v. 43, 1965 p 153–164
(Contract NOw-62-0604-c)
(TG-230-T490; TT-66-62292; AD-639185) CFSTI: HC $1.00/MF $0.50

The equation of diffusion of a chemically reacting substance in the presence of a heterogeneous reaction on an isothermal surface is solved by the integral method using a cubic profile of the concentration in the boundary layer. This solution of the diffusion equation satisfies the power approximation of the non-linear boundary condition. If the chemical reaction rate depends on the concentration of several components, then the solution of the diffusion equation is also a function of the complex pi, which takes into account the magnitude of the initial concentrations and of the diffusion coefficients of the individual components. To generalize the resultant diffusion-convective energy transfer, the potential of the chemical energy transfer of a reacting system is introduced Author (TAB)

N67-11037# Michigan Univ., Ann Arbor. Dept. of Geology and Mineralogy.
STUDY OF POLYTYPIC PHASE RELATIONS AMONG COMPLEX INORGANIC STRUCTURES Semiannual Report, 1 Nov. 1965–30 Apr. 1966

Donald R. Peacor Ft. Monmouth, N. J., Army Electron. Command, Jul. 1966 10 p refs *Its* Rept.-2
(Contract DA-28-043-AMC-01338(E))
(Rept.-07325-2-T; ECOM-01338(E)-2; AD-638918) CFSTI: HC $1.00/MF $0.50

Senaite was found to be closely related to magnetoplumbite and the hexagonal-ferrites. Three dimensional intensity data were collected, analyzed and used for the computation of the Patterson function P (u,v,w). Analysis of the implication function I3 (u,v,o) together with chemical analyses shows that it has the chemical formula Pb (Ti,Fe,Mn,Mg)24O38. Davidite, which has no cation in the closest-packed framework is shown to be isotypic with senaite and to have the formula (Ti,Fe)21O39. Thus senaite is a compositional and structural link between the Ba-ferrite type phases and other closest-packed oxide phases. Data are also presented on nigerite, plumbo-ferrite and CoGeO3 Author (TAB)

N67-11038# Little (Arthur D.), Inc., Cambridge, Mass.
STUDIES IN HIGH TEMPERATURE MASS SPECTROMETRY Progress Report, 1 Oct. 1965–31 Mar. 1966
Alfred Buechler [1966] 3 p
(Contract DA-31-124-ARO(D)-315)
(PR-3; AD-638735) CFSTI: HC $1.00/MF $0.50

A summary is given of studies of molecular structure by electric deflection and mass spectrometry. The systems studied included alkali hydroxides and metaborates and cesium sulfate and related compounds. TAB

N67-11040# Weizmann Inst. of Science, Rehovoth (Israel). Polymer Dept.
MECHANOCHEMISTRY
Aharon Katzir 20 Jul. 1966 5 p
(Grant AF-EOAR-62-58)
(AFOSR-66-1475; AD-637917) CFSTI: HC $1.00/MF $0.50

Contents: Biological mechanochemical conversions; Mechanochemical coupling; The informative ability of dynamic macromolecules; Collagen fibers as a model; Mechanochemical engines and pumps. TAB

N67-11072# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING THE X-RAY ANALYSIS METHOD DURING THE SYNTHESIS OF LEAD, ZINC, MERCURY SELENITES, AND MERCURY SELENIDE
N. A. Filippova, L. A. Martynova, and Y. V. Savina 6 Jun. 1966 9 p refs Transl. into ENGLISH from Sb. Nauchn. Tr., Mosk. Inst. Tsvet. Metal. i Zolota (Moscow), no. 19, 1962 p 795–799
(FTD-TT-65-1535; TT-66-62222; AD-638869) CFSTI: HC $1.00/MF $0.50

During the development of phase analysis it was necessary to synthesize lead, zinc, mercury selenites, and mercury selenide. For the synthesis of selenites the Chukhlantsev method was basically used, and for the synthesis of mercury selenide - the Benzing method. Identification of compounds was carried out basically by two independent analysis methods - chemical and x-ray Author (TAB)

N67-11175# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HETEROPOLYCONDENSATION OF ACETYLFERROCENE WITH CARBAMIDE
I. A. Golubeva and T. P. Vishnyakova 11 Aug. 1966 8 p refs Transl. into ENGLISH from Plasticheskie Massy (Moscow), no. 12, 1965 p 10–12
(FTD-HT-66-474; TT-66-62340; AD-639442) CFSTI: HC $1.00/MF $0.50

The heteropolycondensation of acetyl ferrocene with carbamide yielded a dark infusible powder which proved to be a polyconjugate system with the elemental composition C13H12N2Fe, to have a molecular weight of about 1000, and which decomposed at approx. 350C. The dependence of conductivity of the polymer upon temperature was found to be exponential in the interval 20 to 300C; its specific conductivity was 0.00000047/OHM/CM. TAB

N67-11186# Thiokol Chemical Corp., Denville, N. J. Reaction Motors Div.
CARBORANE-SILOXANE ELASTOMERS Quarterly Progress Report, 19 May–18 Aug. 1966
Nathan Mayes 18 Aug. 1966 26 p refs
(Contract DA-11-070-AMC-852(W))
(RMD-5065-Q8; QPR-6; AD-637858) CFSTI: HC $2.00/MF $0.50

The compound 1,5-di-o-carboranylpentane and the derivatives 1,5 - bis (1 - chlorodimethylsilyl - o - carboran - 2 - yl) pentane and 1,5-bis(1-methoxydimethylsilyl-o-carboran-2-yl)pentane were synthesized. A polymer was prepared by the heterofunctional condensation of the above derivatives, and its thermal and physical properties were characterized Author (TAB)

N67-11190# Stanford Research Inst., Menlo Park, Calif.
A STUDY OF ENERGY TRANSFER PROCESSES IN RADIATION CHEMISTRY: TRIPLET-TRIPLET TRANSFER IN POLYBUTADIENE Technical Report, 1 Mar. 1965–30 Jun. 1966
Morton A. Golub Wright-Patterson AFB, Ohio, AF Mater. Lab., Jul. 1966 33 p refs
(Contract AF 33(615)-2354)
(AFML-TR-66-292; AD-639389) CFSTI: HC $2.00/MF $0.50

Benzene photo- and radiation sensitized cis-trans isomerization of pentene-2, hexene-2, heptene-2, and octene-2 all yield the same photo- and radiostationary cis/trans ratio, viz., 1.0. Yields of benzene triplet formation and radiation-induced unsensitized isomerization of the above olefines are reported. Thin films of polybutadiene containing small amounts of certain triplet-forming organic compounds were isomerized on exposure to ultraviolet light. This demonstrates that triplet-triplet transfer from sensitizer to polymer double bonds is quite efficient in the solid state Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N67-10078# Technical Univ. of Denmark, Lyngby. Ionosphere Lab.
OBSERVATIONS OF THE VLF EMISSION HISS AT 8 kc/s in GREENLAND, 1964
T. Stockflet Jorgensen Apr. 1966 50 p refs
(Rept.-20) CFSTI: HC $2.00/MF $0.50

Data are presented on the occurrence of the VLF emission hiss recorded on 8 kc/s at 3 locations in Greenland during the year 1964. It is shown that hiss of spectral densities above $1\cdot10^{-15}$ $Wm^{-2}(c/s)^{-1}$ observed at latitudes higher than 69° in the Mayaud latitude–local magnetic time coordinate system mainly occurs during the afternoon, evening and early night. The low latitude boundary of this statistically found hiss zone is at approximately 75° around magnetic noon decreasing to less than 69° during the night. The high latitude boundary is at approximately 80°. The

shape and location of the hiss zone does not change significantly as a function of local seasons, but the dependency of the degree of geomagnetic disturbance is clear as the extent of the hiss zone is much smaller during quiet periods than during disturbed periods. Further, the region of maximum hiss activity, which during quiet periods is located at about 70° Mayaud latitude about 1 hour before magnetic midnight, is occurring about 3 hours before magnetic midnight during disturbed periods. Author

N67-10088# Gt. Brit. Ministry of Aviation, London. Technical Information and Library Services.
MEASURING THE SENSITIVITY OF REGENERATIVE SCHEMES [IZMERENIE CHUVSTIVITELNOSTI REGENRATIVNIKH SKHEM]
M. E. Gertsenshtein and Yu. A. Lure'e et al Sep. 1966 10 p refs Transl. into ENGLISH from Izmeritel': Tekhn. (Moscow), v. 5, 1963 p 44–48
(TIL/T-5616) CFSTI: HC $1.00/MF $0.50

The circuit and component characteristics which have significant effects on the accuracy of the measuring circuits are examined and, where possible, improvements suggested. The circuit devised does not need special equipment and ensures a high accuracy in measuring noise-factors. Author

N67-10138# Radio and Space Research Station, Slough (England).
OPTICAL OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FOR THE MONTH OF MAY 1966
May 1966 55 p CFSTI: HC $3.00/MF $0.50

Tabulated data on optical observations of earth orbiting satellites for May 1966 are presented. In addition to the normal observational data, lists of additional observing sites and the observed satellites are given. R.N.A.

N67-10140# Radio and Space Research Station, Slough (England).
OPTICAL OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FOR THE MONTH OF APRIL 1966
Apr. 1966 39 p
CFSTI: HC $2.00/MF $0.50

Tabulated data are presented on optical observations of earth satellites for April 1966. Additional observing sites and the satellites observed are also listed. R.N.A.

N67-10186*# National Aeronautics and Space Administration, Washington, D. C.
STIPULATIONS OF THE INTERNATIONAL TELECOMMUNICATIONS AGREEMENT CONCERNING MILITARY RADIO STATIONS
H. Pressler Apr. 1963 25 p Transl. into ENGLISH from Arch. fur das Post- und Fernmeldwesen (Germany), v. 9, no. 3, 1957 p 183–191
(NASA-TT-F-8463) CFSTI: HC $1.00/MF $0.50 CSCL 17B

The interpretation of Article 48, Chapter V, of the International Telecommunications Agreement concerning military radio stations serving the national defense is discussed. This article is textually reproduced, and its history and origin traced. Ancillary legalistic documents are cited. Emphasis is placed on the stipulation of the absolute freedom concept. R.LI.

N67-10187*# National Aeronautics and Space Administration, Washington, D. C.
REPORT ON THE OBSERVATIONS MADE BY THE PLEUMEUR-BODOU SPACE TELECOMMUNICATION STATION ON THE VARIOUS ORBITAL-POSITIONING PHASES OF SYNCOM II
R. Sueur 21 Aug. 1963 3 p Transl. into ENGLISH of the French Report, 14 Aug. 1963
(NASA-TT-F-8522) CFSTI: HC $1.00/MF $0.50 CSCL 09F

To determine the locus on the earth's surface of the satellite position, observations on the various orbital-positioning phases of Syncom II were made with a control tracker. The azimuth and elevation of the satellite at every instant was recorded. The accuracy of azimuthal information was found to be approximately one degree; that of the elevation information, about one degree for elevations higher than 20° R.LI.

N67-10248# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
ATTENUATION OF RADIO WAVES
In its Radio Meteorol. 1 Mar. 1966 p 269–309 refs (See N67-10241 01-20) GPO: $2.75

Absorption of radio waves by raindrops, gaseous oxygen and water vapor in the atmosphere is discussed. Average conditions of temperature, droplet size, and droplet distribution are assumed for the radio path; and all attenuations are expressed in terms of decibel loss per unit length of the propagation path (dB/km). Attenuation by atmospheric gases is considered, and estimates are made of the range of total gaseous absorption. Total radio path absorption is discussed, and a derivation is given for absorption estimate for other areas. Attenuation in clouds, hail, fog, and rain, rainfall attenuation climatology, rain attenuation effects on radio systems engineering, and thermal noise emitted by the atmosphere are discussed. M.W.R.

N67-10277# Army Missile Command, Huntsville, Ala. Measurement Branch.
METHOD OF DETERMINING SAFE DISTANCES FROM RF TRANSMITTERS
William L. Strickland and David R. Dreitzler 26 May 1966 15 p refs
(RK-TR-66-9; AD-637589) CFSTI: HC $1.00/MF $0.50

A simplified method, based on the free-space radiation equation, for determining the distance from an RF transmitter at which a given field strength is produced is presented in this report. For the convenience of the man in the field, the solution to this equation is presented in the form of a nomograph and a slide rule. Instructions and examples for the use of these aids are given Author (TAB)

N67-10280# Lincoln Lab., Mass. Inst. of Tech., Lexington.
LINCOLN EXPERIMENTAL TERMINAL TIMING AND FREQUENCY CONTROL
Norman L. Daggett 4 Aug. 1966 16 p refs
(Contract AF 19(628)-5167)
(TN-1966-33; ESD-TR-66-399; AD-638198) CFSTI: HC $1.00/MF $0.50

The Lincoln Experimental Terminal timing and frequency control provides digital control signals to the frequency synthesizers which determine transmit and receive frequencies and system timing signals to such equipment as the sequential encoder-decoder and the sync recovery system. Every 200 Msec a new 15-bit frequency control word is sent to the transmit and receive synthesizers, the transmit word containing the information signal plus one-way doppler prediction superimposed on the frequency-hopped base frequency, and the receive word containing one-way doppler prediction plus measured frequency error superimposed on the base frequency. Every 5 ms a sync signal is substituted for the information signal in the transmit word and a separate frequency control word is sent to the sync receiver frequency synthesizer. Timing of all output signals is variable in response to predicted path delay and measured time error Author (TAB)

N67-10284# Michigan State Univ., East Lansing. Div. of Engineering Research.

MINIMIZATION OF BACKSCATTERING OF A METALLIC LOOP BY AN IMPEDANCE LOADING METHOD

J. L. Lin and Kun-Mu Chen 20 May 1966 35 p refs

(Contract AF 19(628)-5732)

(SR-2; AFCRL-66-401; AD-638464) CFSTI: HC $2.00/MF $0.50

The report investigates the minimization of the backscattering of a metallic loop by an impedance loading method. A conducting, circular loop which is loaded symmetrically with two impedances is assumed to be illuminated by a plane wave at normal incidence. The induced current on the loaded loop is determined. The back-scattered field produced by the loaded loop is calculated. If the loading impedances are chosen properly, the induced current on the loaded loop can be modified in such a way that the back-scattered field from the loop vanishes. The optimum impedance for zero backscattering is explicitly determined. Numerical examples are included Author (TAB)

N67-10299# Naval Ordnance Lab., Corona, Calif. Research Dept.

ATTENUATION OF KA-BAND ENERGY BY SNOW AND ICE

James W. Battles and Delbert E. Crane 10 Aug. 1966 13 p refs

(NOLC-670; AD-638303) CFSTI: HC $1.00/MF $0.50

Measurements of the attenuation of electromagnetic energy by snow and the reflection of radiation from snow and ice were made by using an interferometer and manufactured snow and ice in an environmental chamber under closely controlled conditions. The ambient temperature was held at -14F for all measurements. Snow and ice attenuation and reflection measurements are tabulated for various snow densities covering the range from 32 to 39 GHz. Results show that packed snow and greater density produce less attenuation. (Author) Author (TAB)

N67-10317# Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.

A STUDY OF ACOUSTICAL MULTIPATH SYSTEMS. SECTION IV: DELAY LINE Final Report, May 1965–Jun. 1966

D. W. Batteau and G. Patrick Flanagan 1 Jun. 1966 19 p

(Contract Nonr-494(00))

(AD-637878) CFSTI: HC $1.00/MF $0.50

The investigation of the effects of multiple paths on acoustical signals as related to speech recognition and improvement of signal-to-noise ratios is based on the theory that any multipath system may be considered to introduce redundancies in a basic message. These redundancies in the basic message may be used to select a particular message source from among many by the application of an 'attention function' characteristic of the spatial relationships between the source and the receiving mechanism. The attention function provides a model in which the distributed energy of the original pulse which reached the receiving mechanism along paths of different lengths (delayed in time) may be reconcentrated in time to a single pulse with an energy greater than that of the initially received pulse, and thus produce a significant increase n in the subjective signal to noise ratio. Subsequent subjective testing was designed to determine the effects of various headphones and signal to noise ratios on speech intelligibility. Author (TAB)

N67-10324# Signatron, Inc., Lexington, Mass.

SINGULAR SEQUENTIAL DETECTION ON A GAUSSIAN PROCESS

Griffiss AFB, N. Y., RADC, Aug. 1966 25 p refs

(Contract AF 30(602)-3561)

(RADC-TR-406; AD-638340) CFSTI: HC $1.00/MF $0.50

This report presents new theoretical and experimental results illustrating occurrence and non-occurrence of singular sequential detection. Particular concern is made of the commonly offered explanations as to why singular detection really does not violate intuition. Experimental results are given for the detection of RC noise in RC noise . Author (TAB)

N67-10359# ADCOM, Inc., Cambridge, Mass.

STUDY OF TELEMETRY RECEIVER AND RECORDER PHASE LINEARITY PROBLEMS Final Report, 15 Aug. 1965–14 May 1966

Ahmad F. Ghais, Eugene J. Ferrari, and Charles J. Boardman Aug. 1966 203 p refs

(Contract AF 19(628)-5655)

(G-71-F; ESD-TR-66-409; AD-638685) CFSTI: HC $6.00/MF $1.25

The problem of phase nonlinearities in telemetry-receiving systems is studied. The principal data-degrading effect is shown to be intermodulation distortion of FDM telemetry signals. Another form of data degradation, namely intersymbol interference in TDM telemetry signals, is found not to be related directly to phase non-linearities, but rather to the transient response of the receiving system. The noise-loading technique is introduced as an effective means of characterizing, analyzing and measuring intermodulation distortion. Analytical results are established relating the amount of intermodulation distortion to signal and receiving-system parameters. These relationships are verified experimentally using typical telemetry receivers, converters and recorders. Some other sources of data degradation are also identified and evaluated. The study results are used to establish quantitative tradeoffs between the performance parameters of receiving systems. These tradeoffs are then used in formating methods of specification for low data degradation. Improvements that can be implemented in existing and future systems are discussed, and it is recommended that study and development efforts should be undertaken to improve data quality Author (TAB)

N67-10390# Joint Publications Research Service, Washington, D. C.

AUTOMATIC PROCESSING OF INFORMATION

I. A. Khripunov, Kh. B. Shmerman, and A. I. Ol'khovoy 8 Jun. 1965 12 p Transl. into ENGLISH from Avtomat., Telemekhan. i Svyaz (Moscow), no. 9, 1964 p 9–12

(JPRS-30494; TT-65-31205) CFSTI: $1.00

Some of the automatic data processing techniques and equipment used for the long distance transfer of information, and for planning and efficient control of Soviet railroad transport are described. R.N.A.

N67-10420# Federal Scientific Corp., New York.

A STUDY OF CRITICAL-INSTANT SAMPLING OF SPEECH PARAMETERS FOR AUTOMATIC RECOGNITION OF SPOKEN WORDS Final Report, Jul. 1964–Aug. 1965

Mark Weiss Griffiss AFB, N. Y., RADC, Jul. 1966 146 p refs

(Contract AF 30(602)-3519)

(FSC-T-1/141; RADC-TR-65-371; AD-638380) CFSTI: HC $5.00/MF $1.25

A study has been made to advance the development of a general and practical procedure for automatic recognition of spoken words. Two major problems were studied: variations in parameter values of speech due to variations in speech characteristics of different talkers, and due to variations in the duration of spoken words. Included in this study was an analysis of the means and standard deviations of formant frequencies made for a group of twenty talkers, each saying a list of 30 words two times. A range of standard deviations of from 5 percent of the mean formant frequency to 50 percent was observed. For the first time, statistical information has been obtained on the spectra of fricative sounds. One of the serious problems inherent in most techniques of automatic recognition of speech is that of time normalization, since words or parts of words normally are spoken with different durations. A new technique has been investigated which avoids

many of the problems of time normalization. Word patterns which are independent of word duration were generated using critical-instant sampling of the speech data. Recognition tests using these patterns were made to evaluate the relative significance of different critical instants. The results obtained indicate that critical-instant sampling provides effective and efficient patterns on which a general spoken-word recognition procedure may be based. Author (TAB)

N67-10431# WSM, Inc., Nashville, Tenn.
NIMBUS RECEIVING EQUIPMENT DEVELOPED AT WSM, INCORPORATED FOR USE ON WSM-TV WEATHER SHOWS
John H. De Witt, Jr. and Charles Burch [1966] 15 p

Described is the modified electronic equipment for reception of weather pictures from the Nimbus satellite. It consists of a field effect transistor preamplifier, a modified FM police receiver, and an electronic readout system with tape recorder. The 2400 hz sub-carrier from the receiver is amplitude modulated with video information in the satellite and the rectified signal is fed directly to an oscilloscope cathode where a diode sets the positive dc level so that video information is transmitted up to 4800 pulses per second. Attached block diagrams of the system show that the receiver can be fed either directly into the readout system or into the tape recorder for later readout. G.G.

N67-10447# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
A TECHNIQUE FOR THE SYNTHESIS OF SHAPED-BEAM RADIATION PATTERNS WITH APPROXIMATELY EQUAL-PERCENTAGE RIPPLE
R. F. Hyneman 3 Oct. 1966 102 p refs
(FR-66-14-241)

The method is based on the controlled location of the zeroes of the pattern function in the complex pattern plane. It is shown that the relative displacement of these pattern zeroes from the real sin θ axis determines the magnitude of ripple obtained with the synthesized pattern. The zero locations are approximately constrained by starting with a fan or sector pattern having known zero locations. The sector pattern is then warped or perturbed to the pattern of desired shape by deterministic perturbations of these zero locations. It is found that the design ripple of the sector pattern is approximately maintained during this process. With an increase in ripple magnitude, more faithful reproduction of the desired pattern in regions of discontinuous value or slope is possible. Independent control of ripple level within the shaped beam region and sidelobe level without is achieved. Several examples of shaped beam patterns (including $\csc^2\theta$ patterns) are presented and discussed. It is shown that for a given pattern magnitude function, a number of pattern phase functions exist, each of which corresponds to a different aperture distribution function. Author

N67-10506# Technical Univ. of Denmark, Lyngby. Lab. of Electromagnetic Theory.
OPTIMIZATION OF THE RERADIATION PATTERN OF A VAN ATTA REFLECTOR Scientific Report No. 4
J. Appel-Hansen Jun. 1966 75 p refs
(Contract AF 61(052)-794)
(R-52; AFCRL-66-634; AD-637951) CFSTI: HC $3.00/MF $0.75

An optimization of the reradiated field from a linear Van Atta reflector consisting of four equispaced parallel half-wave dipoles is made. Before the optimization process is discussed, a further and more extensive theoretical investigation than the one given in Scientific Report no. 2 (AD-613 607) is made. A general expression for the reradiated field is established so that it is possible to study the influence of asymmetries in the location of the dipoles, unequal length of the transmission lines, and a mismatch between the dipoles and the transmission lines. In particular, the dependence of the reradiation pattern on the length and the characteristic impedance of the transmission lines, the imaginary part of the dipole impedances, and the spacing between the dipoles, is investigated. The reradiation pattern is optimized so that the back-scattering, as a function of the angle of incidence, has its largest minimum value. The optimization is performed both when coupling is neglected and when it is taken into account. In the optimization consideration is given to the shape of the reradiation pattern near the direction back in the direction of propagation of an incident wave. Author (TAB)

N67-10512# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE QUALITY OF THE LINCOLN CALIBRATION SPHERE
Michael L. Burrows 22 Aug. 1966 43 p refs *Its* Tech. Note 1966-41
(Contract AF 19(628)-5167; ARPA Order 600; Proj. Defender)
(ESD-TR-66-417; AD-638442) CFSTI: HC $2.00/MF $0.50

Due to the relatively high background noise level of the radar range used to measure the Lincoln Calibration Sphere (LCS) before launch, the upperbound estimates of the backscattering cross section variation made at the time included a large contribution generated by the range itself. By comparing the range measurements and the mechanical measurements made on the LCS with measurements made on three other similarly constructed spheres, a refined estimate of the quality of the LCS is made. The comparison makes use of more precise range and mechanical measurements made on the other three spheres and of an application of perturbation theory to compute the variation of cross section from the mechanical measurements. The unexpectedly large signal scattered by the equatorial joint is an unwelcome addition to the backscattered field and is discussed in some detail. It is concluded that, at all frequencies below about 25 GHz, the r.m.s. deviation in backscattering cross section is not greater than 0.15 db, and that the average backscattering cross section differs from that of a perfect sphere of radius 0.56469 m by an amount which is small compared with the r.m.s. deviation. Author (TAB)

N67-10552# Radio and Space Research Station, Slough (England).
KINETHEODOLITE OBSERVATIONS OF SATELLITES RECEIVED BY THE SATELLITE ORBITS GROUP FROM MALTA FOR APRIL 1966
1966 27 p refs *Its* Issue No. 15 CFSTI: HC $2.00/MF $0.50

Time, azimuth, and elevation data are presented from satellite observations during April, 1966. Information is included on the Transit 4B rocket, Alouette rocket, Midas 7, Dash 2, Polyot 1, Explorer 19 satellite, Cosmos 44 rocket, Ablestar rocket, and Thor Altair. A.G.O.

N67-10718# Stanford Univ., Calif. Stanford Linear Accelerator Center.
ACCURATE PHASE LENGTH MEASUREMENTS OF LARGE MICROWAVE NETWORKS
J. Weaver and R. Alvarez May 1966 23 p refs Presented at the Intern. Symp. on Microwave Theory and Tech., Palo Alto, Calif., May 1966
(Contract AT(04-3)-400)
(SLAC-PUB-181; HEPL-442; CONF-660541-1) CFSTI: HC $1.00/MF $0.50

The Stanford two-mile linear accelerator uses 240 single-input-port, four output-port, S-band, rectangular-waveguide networks to feed r-f energy sixty to seventy feet from the klystrons above ground to ten-foot-long, disc-loaded circular-waveguide, accelerator sections below ground. During installation it is necessary to permanently adjust the phase lengths of the four network branches to be within ± 4.5 electrical degrees of the design lengths for r-f wave and electron beam synchronization. A modulated reflection phase length comparison method is used whereby a small signal is sent into each branch and reflected, in turn, by a diode switch, which is turned on and off at a 1kHz rate. A null occurs in the amplitude modulation of the sum of a large reference signal and the small reflected signal when the two signals are

nearly in phase quadrature. The reflectors are placed so that the network branches are properly adjusted when the nulls from all branches occur for the same setting of a variable phase shifter in the measurement line. Small mismatches and multiple power divisions do not affect the accuracy of this method. Frequency, temperature and air pressure are the main environmental conditions affecting the measurement and are discussed along with the design of the reflecting diode switch, which is mounted in a vacuum-sealed waveguide flange. Author (NSA)

N67-10755*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE OBSERVATIONS MADE AT SATELLITE STATION STADE
Horst Kohnke (1966) 2 p Transl. into ENGLISH from German (NASA-TT-F-9311) CFSTI: HC $1.00/MF $0.50 CSCL 22C

The time, magnitude, and variation in brightness are tabulated for the satellites observed from March 2 to March 7, 1965. N.E.N.

N67-10764# European Atomic Energy Community, Ispra (Italy). Div. of Engineering Technology.
METHOD FOR THE CHOICE OF CARRIER FREQUENCES IN THE DATRAC SYSTEM (DATRAC: DATA TRANSMISSION VIA CABLE) [METHODE FUER DIE ASWAHL DER TRAEGERFREQUENZEN IM DATRAC-SYSTEM (DATRAC: DATENUEBER-TRAGUNG UEBER KABEL)]
W. Becker Jun. 1966 20 p In GERMAN
(EUR-2969.d)

Some basic technical view-points concerning a frequency multiplex system for data transmission over short distances (e.g., 1 km) are dealt with. For this system it is not of main importance to use the theoretically possible information flux admitted by the given transmission means (e.g., coacial cable). In order to keep the lay-out of the system as simple as possible for the provided application (on-line computer operation, interconnection of two laboratories of the reactor center, etc.) frequency mixers in the receiver were avoided. Thus the channel selection filters are directly tuned to the corresponding channel center frequencies. Distinction is made between two kinds of parallel systems, which are exclusively concerned: (1) systems, where the time response of the filters is the same on all channels, and (2) systems, where the relative channel width is the same for all channels. A simple procedure to fix the channel center frequencies is described considering the transmission speed, the safety margin from the response time and the possible interference by harmonics or first order mixed frequencies, simultaneously trying to put the overall band of transmission in its frequency range as low as possible for reasons of attenuation and frequency stability. Examples are given, and it is referred to the factors to be considered with a simultaneous switch-through of all receiver channels, in order to impede transients. Author (NSA)

N67-10879# National Bureau of Standards, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.
IONOSPHERIC TELECOMMUNICATIONS LABORATORY Progress Report No. 15, Jul.– Dec. 1965
29 Aug. 1966 164 p refs
(ITSA-TM-4) CFSTI: HC $5.00/MF $1.00

Technical information on radio propagation factors affecting design and use of radio systems is provided, with emphasis on long range radio transmission problems, and measurement methods for radio communications, navigation, timing, detection, and positioning systems. Radio wave propagation studies are carried out for ionospheric, ground wave, and line of sight paths to define the limitations, disturbances, and capacity of the transmission medium as a channel. Standards and methods of measurements are developed for radio systems to fulfill the needs for federal agencies and industry involved in radio telecommunication operation and regulation. Studies of information theory and coding, modulation, and antenna design are directed toward improvement of the reliability of systems, and to the efficient utilization of the radio frequency spectrum. Author

N67-10881*# RAND Corp., Santa Monica, Calif.
MULTIPLE-ACCESS TECHNIQUES FOR COMMUNICATION SATELLITES: DIGITAL MODULATION, TIME-DIVISION MULTIPLEXING, AND RELATED SIGNAL PROCESSING
C. R. Lindholm Sep. 1966 98 p refs
(Contract NASr-21(02))
(NASA-CR-79748; RM-4997-NASA) CFSTI: HC $3.00/MF $0.75 CSCL 17B

Background theory and data are presented as an aid for designing and evaluating digital and time-division approaches to the communication satellite multiple access problem. Specific features of digital techniques are examined, with emphasis placed on time-division multiplexing, error correction codes, analog-to-digital conversion methods, and synchronization. Amplitude and frequency modulation, and phase shift keying are discussed from the viewpoint of performance parameters. System difficulties which may be encountered in time-division multiplexing are enumerated. Also considered are the pulse code and delta modulation techniques used in analog-to-digital and digital-to-analog conversion, along with the performance parameters characterizing system error rate or signal-to-noise ratio. Tables and graphs are included to show the relations needed in evaluating system performance. M.G.J.

N67-10884*# RAND Corp., Santa Monica, Calif.
A CLASS OF CODES FOR MULTIPLE-ACCESS SATELLITE COMMUNICATION SYSTEMS
P. M. Spira Sep. 1966 30 p refs
(Contract NASr-21(02))
(NASA-CR-79745; RM-5131-NASA) CFSTI: HC $2.00/MF $0.50 CSCL 09D

A mathematical method is described for allocating time and frequency in communication satellite systems that use time–frequency multiplexing for random multiple access. Algorithms are given for constructing low interference address codes for various sizes of time–frequency matrixes and address lengths. As many addresses as possible are constructed so that no two of them have more than one chip in common. At the same time, for a fixed address length, the number of addresses containing a given chip can be made arbitrarily large and will be almost exactly proportional to the number of chips in the time–frequency matrix. Minimal interference is obtained by demanding that any two addresses have at most one common chip, and by the symmetry of the construction to facilitate analysis of system performance. It was also found possible to satisfy continuous transmission requirements without losing the ability to accommodate large numbers of users. M.G.J.

N67-10921# Navy Electronics Lab., San Diego, Calif.
COMBINED-ENVIRONMENT TESTING OF SHIPBOARD ELECTRONIC EQUIPMENT: ANALYSIS OF DATA Research Report, During May 1966
Floyd Robinson 29 Jun. 1966 14 p refs
(NEL-1385; AD-639247) CFSTI: HC $1.00/MF $0.50

A regression analysis was performed on data previously recorded during a combined-environment test on an intermediate frequency, amplitude modulation module, part of the signal converter of the Communications Central AN/SRC-16. The results showed that the technique is promising as an aid to assessing the effects of combined-environment testing, particularly for identifying the environmental factor that plays the principal part in performance deterioration. Author (TAB)

N67-10929# Navy Electronics Lab., San Diego, Calif.
ELF SURFACE ELECTRIC AND MAGNETIC FIELDS AND UNDERWATER ELECTRIC FIELDS Research Report, Mar. 1965–May 1966
H. G. Hughes 27 May 1966 21 p refs
(NEL-1379; AD-639246) CFSTI: HC $1.00/MF $0.50

Measurements of ELF noise on land and under the ocean to depths of 1000 feet were made in a joint NEL-USL program. Spectral analysis of recorded data is presented. Underwater measurements revealed significant peaks in the region of the first resonant frequency of the earth-ionosphere cavity between 7 and 10 c/s Author (TAB)

N67-10931# Navy Electronics Lab., San Diego, Calif.
CALCULATION OF SIGNAL-TO-NOISE RATIO FOR HF PROPAGATION PREDICTION Research and Development Report, Apr. 1964–Apr. 1966
D. B. Sailors 21 Jun. 1966 58 p refs
(NEL-1383; AD-639253) CFSTI: HC $3.00/MF $0.50

Calculation of signal-to-noise ratio for operational sky-wave modes at high frequency is described. The process applies to a computer program written in NELIAC 5M for the CDC 1604. Calculation includes factors of field strength, antenna gain, signal voltage, and noise. Noise data used are based on CCIR Report No. 65. Configurations for most hf antennas, including log periodic, are provided for. Means are provided for comparing NEL and CRPL program results. The NELIAC 5M program is presented in NEL Report 1358 (AD-633 716). Selection of operational modes is covered in NEL Report 1364 (AD-633 893). (Author) TAB

N67-10954# ITT Federal Labs., Nutley, N. J.
APPLIED RESEARCH STUDY ON SATELLITE COMMUNICATIONS Final Report, 1 Jan. 1965–30 Jun. 1966
M. Epstein, M. Weinberg, I. Krause, E. Imboldi, R. Gollhardt et al
30 Jun. 1966 206 p
(Contract DA-28-043-AMC-00442(S))
(Rept.-5; AD-638911) CFSTI: HC $6.00/MF $1.25

The purpose of this applied research study is to advance the state of the art in the field of satellite communications. The study is divided into two task areas: (1) Multiple access techniques consists of studies in four prime areas: device effects on transmission, optimum coding study, time division multiple access study, and design study for the ADCSP. (2) Current ground environment design covers ground power control in multiple access systems, multichannel loading of small channel capacity military communication systems, and investigation of fm threshold extension techniques. (Author) TAB

N67-10966# Rand Corp., Santa Monica, Calif.
INFORMATION THEORY AND ALTERNATE HYPOTHESIS TESTS
Julian J. Bussgang (Signatron, Inc.) and Michael B. Marcus Sep. 1966 36 p refs
(P-3441; AD-638449) CFSTI: HC $2.00/MF $0.50

Lindley's concept of the information in an experiment is used to study alternate hypothesis statistical tests. A test is considered to be a combination of a sampling rule and a decision rule which is based on the samples taken. Two information functions are formed for these tests. The information (about the unknown parameter) contained in the samples that are taken and the information contained in the decision they lead to. The former quantity is always greater than the latter with equality if and only if the test is a sequential probability ratio test (sprt), neglecting the excess over the boundary. If the information contained in the samples taken in one alternate hypothesis test is greater than the information contained in the samples taken in another than it has greater expected test length. This result together with the result that the sprt, neglecting excess, is the unique test that utilizes all the information contained in the samples provides a proof of the standard result on the optimal character of the sprt, for the sprt neglecting excess. The major purpose of this paper is to develop an information theoretic analysis of alternate hypothesis tests. Using this approach new results on sprt's and alternate hypothesis tests in general are obtained. Author (TAB)

N67-10972# Motorola, Inc., Scottsdale, Ariz. Aerospace Center.
AN ADVANCED METEOROLOGICAL SOUNDING SYSTEMS (DESIGN PLAN) Scientific Report No. 1
Elvin F. Krasin and Kenneth J. Wood 30 Nov. 1965 270 p refs
(Contract AF 19(628-4215)
(AFCRL-66-256; AD-638874) CFSTI: HC $6.00/MF $0.50

The purpose was to provide a design plan for an optimum ground based vertical sounding system to obtain accurate meteorological data from balloon or rocket launched radiosondes. The report includes a description of an optimum system. A discussion of the performance requirement for the components, and an analysis of the slant range, altitude, and telemetry errors inherent in the proposed system. The optimum system provides continuous and automatic reception, extraction, reduction, and recording of slant range, telemetry, time, and antenna coordinates. Unambiguous slant range is determined by the time interval between start and stop pulses generated by a pseudo-noise (pn) code transmitted from the ground, turned around by the transponder, and received by the ground station. Telemetry is accommodated by two channels, one continuous and the other time division multiplexed. The commutated channel also provides calibration information for all sensors. The system design uses solid state devices throughout, with reliability and long life emphasized in the ground equipment and simplicity, low cost, and low power drain emphasized in the radiosonde. The system design provides operation at slant ranges up to 300 km with only 35 mw of radiosonde transmitter power and a probable error in slant range of less than 100 feet. The multichannel telemetry is processed with a total system inaccuracy of less than 0.1 percent. The ground antenna design is discussed with the various tradeoffs.
Author (TAB)

N67-10991# New England Univ., Armidale (Australia). Dept. of Physics.
C-W OPERATION OF SPARK TRANSMITTERS Final Report
K. Landecker May 1966 68 p refs
(Grant Nonr(G)-0009-64)
(AD-639058) CFSTI: HC $3.00/MF $0.75

A spark oscillator and transmitter was developed producing undamped (C-W) oscillations at frequencies of 10 Mc/s. with the aid of a special type of Ferrite transformer and slow wave transmission lines with ceramic high permittivity dielectric. The production of R.F. powers in the Megawatt range and the extension of the frequency range to about 100 Mc/s are envisaged but have not been achieved so far mainly because of insulation difficulties. High frequency switching devices other than Ferrite transformers such as shock wave switches and solid state rectifiers have been investigated but found unsuitable for the production of sustained oscillations Author (TAB)

N67-11013# Rome Air Development Center, Griffiss AFB, N.Y. Research and Technology Div.
ELECTROMAGNETIC COMPATIBILITY: A POSITION PAPER
Woodrow W. Everett, Jr. and Robert Powers Sep. 1966 25 p refs Presented at the Electromagnetic Compatibility Symp., San Francisco, 11–13 Jul. 1966 Submitted for Publication
(RADC-SP-66-4; AD-639584) CFSTI: HC $1.00/MF $0.50

Consideration is directed toward electromagnetic compatibility as viewed from the control aspect. Emphasis is upon an intersystem approach of improving the overall electromagnetic enviroment Author (TAB)

N67-11014# Colorado Univ., Boulder. Electrical Engineering Dept.

AN EXPERIMENTAL STUDY OF GROUND WAVE PROPAGATION ACROSS SEMI-INFINITE STRIPS AND ISLANDS Scientific Report No. 35

W. I. Tsukamoto, R. J. King, and S. W. Maley 17 Mar. 1966 70 p refs

(Contract POR-65-504)

(AFCRL-66-252; AD-639500) CFSTI: HC $3.00/MF $0.75

Experimental amplitude and phase measurements of electromagnetic ground wave propagation across semi-infinite strips and islands were conducted for normal incidences. Models for propagation were used with aluminum plates simulating highly conducting media and water simulating imperfectly conducting media. The frequency used was 4.2937 Gc/s. An open-end waveguide located at the water surface and a small switching dipole were used as the transmitting and receiving antennas, respectively. Both amplitude and phase measurements were made by using a modulated scattering dipole technique. The theoretical formulation for normal incidence very low frequency (vlf) ground wave propagation across a simple mixed path was developed by J. R. Wait, using a perturbation technique. Waits work was extended to semi-infinite strips and islands by R. J. King who used an equivalent formulation in an elliptic coordinate system. In both formulations, an approximate solution for the forund wave attenuation function was obtained. Computer methods were used by King for numerical calculations. The experimental data obtained verified the theoretical calculations and also substantiated the limitations of theory implied in the formulation Author (TAB)

N67-11015# Colorado Univ., Boulder. Electrical Engineering Dept.

THE GROUND-WAVE ATTENUATION FUNCTION FOR PROPAGATION OVER A HIGHLY INDUCTIVE SURFACE Scientific Report No. 37

R. J. King and G. A. Schlak 1 Aug. 1966 33 p refs

(Contract POR-65-504)

(AFCRL-66-603; AD-639499) CFSTI: HC $2.00/MF $0.50

Propagation of an electromagnetic ground wave over a plane surface in which the argument of the surface impedance is greater than wavelength/4 but less than wavelength/2 is considered in some detail. The numerical distance, p, over such a surface is characterized by 0 < or = arg p < or = wavelength/2. The ground wave behaves in a rather unusual manner, and this is attributed to the interaction of phasors representing a trapped wave and a Norton surface wave. Approximate expressions are derived which determine the magnitude of the ground wave attenuation function at its maxima and minima as well as the phase at these points and the numerical distances where these maxima and minima occur. A method is also given for estimating the asymptotic phase for large absolute valve of p which was previously not possible. Finally, detailed curves are presented which show the amplitude and phase of the ground wave attenuation function versus p. These curves should prove useful to practicing radio engineers attempting to make calculations for surface wave propagation over corrugated, stratified or rough surfaces Author (TAB)

N67-11023# Mitre Corp., Bedford, Mass.

CHARACTERISTICS AND UTILIZATION OF FORWARD-ACTING ERROR CONTROL EQUIPMENT FOR DATA COMMUNICATIONS

L. L. Stine Bedford, Mass., AFSC, Electron. Systems Div., Aug. 1966 33 p refs

(Contract AF 19(628)-5165)

(MTR-216; ESD-TR-66-295; AD-639254) CFSTI: HC $2.00/MF $0.50

A mathematical model is developed which provides criteria for utilizing, in an optimal fashion, forward error correction devices for retransmission data communications systems. The devices are specified in terms of delay and error correction capability. System performance is described by the defined terms of error correction improvement factor; information throughput, and channel availability Author (TAB)

N67-11028# Washington Univ., Seattle. Dept. of Electrical Engineering.

EQUALLY SPACED SPHERICAL ARRAY Technical Report No. 97

Andrew K. Chan, Akira Ishimaru, and Rubens A. Sigelmann Feb. 1966 45 p refs

(Contract AF 19(628)-2763)

(AFCRL-66-532; AD-639434) CFSTI: HC $2.00/MF $0.50

The report presents a new method of analyzing the radiation characteristics of a spherical array. The existing method of finding the characteristics of an array on a curved surface using computers does not provide a means of predicting the sidelobe level and beamwidth of the pattern. In this report, the theory of unequally spaced arrays developed by Ishimaru is applied to this problem and the radiation characteristic is found to behave as $\sin(\omega)/u$. The elements of the array are arranged as a series of circular arrays of different radii on the spherical surface. The resulting radiation pattern for constant amplitude and element spacing of one wave length is discussed in detail. The validity of the theory is demonstrated by an experimental spherical array which employs half-wavelength dipole elements on an Eccoform sphere. Due to the difficulty of exciting each element of the array a plane wave is used to excite the array. Scattered wave is measured and compared with the theory Author (TAB)

N67-11039# Stanford Research Inst., Menlo Park, Calif.

SRI PARTICIPATION IN VOLTAGE BREAKDOWN AND ROCKET CHARGING EXPERIMENTS ON NIKE-CAJUN ROCKET AFCRL AD 6.841 Scientific Report No. 3

Joseph E. Nanevicz, John B. Chown, Edward F. Vance, and James A. Martin Aug. 1966 65 p refs

(Contract AF 19(628)-4800)

(AFCRL-66-588; AD-638422) CFSTI: HC $3.00/MF $0.75

Results of antenna voltage breakdown and rocket charging experiments on the supersonic flight of Nike-Cajun Rocket AD 6-841 are presented. Rocket altitudes up to 340,000 feet and rocket velocities up to 5000 feet per second were obtained. Flight-test measurements of the voltage breakdown of a VHF quadra-loop antenna and an X-band slot antenna are compared to static laboratory measurements. Modification of antenna breakdown characteristics by local aerodynamic effects and other effects are shown to exist. The electric field meter experiment, designed to measure both convection currents and true electric field, is described. Flight-test measurements of true electric field and rocket charging at low altitudes and of convection currents at high altitudes are presented. Convection currents are shown to be correlated with the VHF antenna voltage breakdown Author (TAB)

N67-11047# Naval Ordance Lab., Corona, Calif.

DESIGN OBJECTIVES FOR TELEMETRY R-F TRANSMISSION LINKS FOR THE PERIOD 1960–1970

T. B. Jackson 15 Apr. 1966 43 p refs Third Revision Supersedes NAVWEPS-8146; see N63-22132

(NAVWEPS-8850; NAVWEPS-8146; AD-634368) CFSTI: HC $2.00/MF $0.50

Performance characteristics, design limitations, and special operational features required in a general-purpose uhf telemetry transmission link are presented. Separate consideration is given to the transmitter, power amplifier, preamplifier-converter, distribution amplifier, channel-selection receiver, and receiving antenna portions of the link. Flexibility of operation and provision for adapting the ground station complex to several basic applications are emphasized. Author (TAB)

N67-11051# Burndy Corp., Norwalk, Conn.
INTERCONNECTING DEVICES AND TECHNIQUES FOR TELEPHONE COMMUNICATION EQUIPMENT Final Report, 20 Jun. 1962–30 Dec. 1965
Richard P. Stelling and Mark Auriana Jun. 1966 122 p refs
(Contract DA-36-039-SC-90721)
(AD-637831) CFSTI: HC $4.00/MF $0.75

The objective of this work was to develop electrical connectors for use with flat flexible cable. Plug and receptacle type connectors and adapters for hermetic feed thru and printed circuit board applications were required. The first phase of this work was the evaluation of three methods of contacting the conductors of the cable without stripping the insulation. Insulation piercing sawtooth contacts that make a sliding siping contact were selected. The second phase resulted in development models of a plug, hermetic feed thru, and ultra-miniature printed circuit connector adapter. These models were laboratory tested to ascertain electrical capabilities; favorable results were recorded. The design and manufacture of engineering models constituted the third phase of the work. The design consists of molded plastic inserts within non-magnetic metal housings and sawtooth type contacts to pierce the cable insulation as in the development models. Considerable difficulty was encountered in attempting a hermetic seal of 0.016 diameter pins on 0.050-inch centers. Testing of many materials resulted in the selection of molybdenum for the pins. The final phase was the evaluation of the engineering models. Qualification tests were performed to the proposed specification. These tests indicated good electrical qualities, but some problems in the areas of environmental sealing and alignment of contacts for closed entry purposes. Author (TAB)

N67-11073# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CODES IN ENGINEERING
Yu. G. Zarenin and V. L. Inosov 4 Apr. 1966 267 p refs
Transl. into ENGLISH of the book "Kody V Tekhnitsi" Kiev, "Tekhnika" Publishing House, 1964 p 1–251
(FTD-TT-65-1558; TT-66-62228; AD-638878) CFSTI: HC $5.00/MF $1.25

Contents: Basic concepts and notations; reliability of transmission of information and increasing the reliability of coding methods; comparison of different coding methods; coding and codes in communication engineering; coding and codes in remote control; coding and codes in computer engineering. Author (TAB)

N67-11107# Air Force Cambridge Research Labs., Bedford, Mass. Microwave Physics Lab.
TRANSIENT SIGNAL PROPAGATION IN LOSSLESS, ISOTROPIC PLASMAS, VOLUME II
R. E. Haskell and C. T. Case Jun. 1966 30 p refs *Its* Phys. Sci. Res. Paper No. 241
(AFCRL-66-234(II); AD-638803) CFSTI: HC $3.00/MF $0.50

The asymptotic behavior of transient signal propagation in lossless, isotropic plasmas is discussed at length for a typical input signal of a step modulated sine wave. A generalized saddle point integration is carried out that gives a continuous solution for the dispersed signal everywhere except at the signal wave front. The solution for the wave front is obtained by using a high-frequency expansion technique. Universal curves are presented for the behavior of the distorted signal as a function of the plasma frequency signal as a function of the plasma frequency, signal frequency, and propagation distance. The solution is a very good approximation for plasma propagation lengths that are long compared to a wavelength. Author (TAB)

N67-11115# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
EVALUATION OF UHF ANTENNA COUPLERS TYPES CU-691/U AND CU-692/U Final Report
James G. Dong Nov. 1965 40 p refs
(RD-65-124; PB-169404) CFSTI: $2.00

Performance characteristics and suitability for use by the Federal Aviation Agency were evaluated for two ultrahigh frequency antenna couplers which use passive networks of tandem coaxial cavities operating as selective filters. Both couplers, one designed for two-channel and the other for four-channel operation, gave improved radiation coverage; and their multicoupling capability provides a method for reducing the number of antennas required at Remote Communication Air/Ground facilities. M.W.R.

N67-11123# Continental Electronics Systems, Inc., Dallas, Tex.
SOLID-STATE HIGH-POWER LOW-FREQUENCY TELEMETRY TRANSMITTERS
J. D. Rogers and J. J. Wormser 1 Sep. 1966 23 p refs

A discussion is given of the unique and practical advantages inherent in the propagation of low frequency and very low frequency transmission. Of particular interest are lightweight transmitter units packaged in small containers. Areas considered include information transmission, amplifier designs, rf output network and PA interrelationships, cooling systems, and experimental verification. Conclusions are that the conventional center tapped push-pull switching amplifier is preferred in the low frequency band, and that complex tuning procedures can be avoided by using a broadband rf output filter and digital techniques throughout the driver. C.T.C.

N67-11177# Navy Electronics Lab., San Diego, Calif.
AMPLITUDE-COMPARISON DIRECTION-FINDING ANTENNA SYSTEM
V. J. Meyers 22 Jun. 1966 18 p
(NEL-1382; AD-638903) CFSTI: HC $1j00/MF $0.50

Theoretical study leads to the recommendation that an amplitude-comparison system consisting of eight antennas with a 45-degree beam width be used for the direction finding portion of the small ship direction finding and analysis receiver. An eight-antenna system reduces bearing inaccuracies by a factor of two as compared with a four-antenna system Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N67-10146# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
THE PROGRAM FOR THE DIGITAL COMPUTER UMC-1 FOR THE CALCULATION OF A LIFE TIME OF AN EXCITED STATE MEASURED BY DELAYED COINCIDENCES [PROGRAM DLA MASZYNY CYFROWEJ UMC-1 NA OBLICZENIE CZASU ZYCIA STANU JADROWEGO WYZNACZONEGO METODA OPOZNIONYCH KOINCYDENCJI]
Alicja Janiszewska and G. Pytkowicz Apr. 1966 15 p In POLISH
(Rept.-472/PL) CFSTI: HC $1.00/MF $0.50

A program for the UMC-1 digital computer for calculating the lifetime of an excited state, measured by delayed coincidences, is presented. The program evaluates coefficients a and b in the formula $\ln N_i = a + bt_i$, where N_i is the number of delayed coincidences, and t_i the delay time. Error $\triangle b$ is also calculated in the program. R.Ll.

N67-10323# Mitre Corp.,Bedford, Mass.
STUDIES OF DISPLAY SYMBOL LEGIBILITY. PART XIII: STUDIES OF THE LEGIBILITY OF ALPHANUMERIC SYMBOLS IN THE BUIC SYMBOL
Glenn C. Kinney and Diana J. Showman Aug. 1966 35 p refs
(Contract AF 19(628)-5165)
(MTR-234; ESD-TR-66-302; AD-638664) CFSTI: HC $2.00/MF $0.50

The legibility of alphanumerics for BUIC system displays was studied in three experiments. Four fonts, standard Leroy, Idealized Early BUIC, Idealized Late BUIC, and Stimulated Late BUIC, were tested in single-symbol, controlled exposure-time, recognition tests. The Early BUIC font was less legible than standard Leroy; but after some symbol changes were made, the new font (Idealized Late BUIC) was more legible than the earlier font. When the improved alphanumerics were simulated to appear as they do on the display console, they were less legible than the idealized alphanumerics. Symbol changes are recommended, and BUIC operators are urged to exercise caution in reading the displays
Author (TAB)

N67-10334# RAND Corp., Santa Monica ,Calif.
COMPUTATIONAL LINGUISTICS: RESEARCH IN PROGRESS AT THE RAND CORPORATION
David G. Hays Aug. 1966 10 p Submitted for Publication
(P-3436; AD-637929) CFSTI: HC $1.00/MF $0.50

In the late fall of 1957 a continuing research project was established. One of the first themes of the groups doctrine was that linguistic research would be necessary before automatic translation could be made real; another, conceived soon after, was that a parsing program could be independent of the grammar of any particular natural language. A modestly successful system for Russian-to-English translation was assembled by 1960 (the dictionary, grammar, and rules of translation were all very small), but by then it had become clear that the broader field of computational linguistics deserved general attention, and that machine translation should either be pursued as a developmental task, using existing techniques for a practical purpose, or set aside to await progress of a fundamental nature. The latter course was followed at RAND. The current work of the linguistics group includes theoretical studies, descriptive studies of English and Russian, and development of basic computing tools
Author (TAB)

N67-10360# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.
SYSTRAN (SYSTEMS ANALYSIS TRANSLATOR): A DIGITAL COMPUTER PROGRAM, SUPPLEMENT ONE Final Report, Oct. 1964–Aug. 1965
E. B. Weis, Jr. and D. L. Lajeunesse Mar. 1966 86 p refs
(AMRL-TR-65-133, Suppl. I; AD-638168) CFSTI: HC $3.00/MF $0.75

SYSTRAN was originally developed around a data acquisition system and was primarily intended for use in analysis of periodic and transient signals. Although the system included some capability for handling random data it was limited. The additions have been made for the purpose of handling unusual data (including random). Extensions of the capability of the original program, corrections to the original program, and listings of all modifications and additions are described. In particular this report describes the addition of computing capability for accomplishing Digital Filtering, Probability Density Function Calculation, and Random Number Generation. The report discusses all aspects of the program essential to competent usage
Author (TAB)

N67-10367# Woods Hole Oceanographic Institution, Mass.
FACTOR ANALYSIS
Derek W. Spencer Jul. 1966 75 p refs
(Contract Nonr-2196(00))
(WHOI-66-39; AD-637792) CFSTI: HC $3.00/MF $0.75

The technique of factor analysis, developed by psychologists, is finding application in many fields of science. This report discusses the method, some applications and gives a detailed description of a FORTRAN II computer program to perform a varimax solution and calculate factor scores. The program was written for a G. E. 225 computer with 8K memory and four tape handlers
Author (TAB)

N67-10446# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
CHANGE CONTROL IN AUTOMATED DESIGN
John K. Brown 17 May 1966 21 p refs Presented at the 3d Ann. Share Automated Design Workshop, New Orleans, 17 May 1966
(Douglas Paper-3875)

The problem of maintaining drawings of large missile and space systems up to the most recent revisions can be solved within an automatic change control system. The following topics are discussed: (1) the change control system requirements, (2) the organization of drawing data into drawing files, (3) the routines for realizing the change control requirements, and (4) the system incorporating these routines in their logical sequence.
Author

N67-10456# Massachusetts Inst. of Tech., Cambridge.
PILOT: A STEP TOWARD MAN-COMPUTER SYMBIOSIS
Warren Teitelman (Ph.D Thesis) Sep. 1966 193 p refs
(Contract Nonr-4102(01))
(MAC-TR-32; AD-638446) CFSTI: HC $5.00/MF $1.00

PILOT is a programming system constructed in LISP. It is designed to facilitate the development of programs by easing the familiar sequence: write some code, run the program, make some changes, write some more code, run the program again, etc. As a program becomes more complex, making these changes becomes harder and harder because the implications of changes are harder to anticipate. In the PILOT system, the computer plays an active role in this evolutionary process by providing the means whereby changes can be effected immediately, and in ways that seem natural to the user. The user of PILOT feels that he is giving advice, or making suggestions, to the computer about the operation of his programs, and that the system then performs the work necessary. The PILOT system is thus an interface between the user and his program, monitoring both the requests of the user and the operation of his program. The user may easily modify the PILOT system itself by giving it advice about its own operation. This allows him to develop his own language and to shift gradually onto PILOT the burden of performing routine but increasingly complicated tasks
Author (TAB)

N67-10551# European Atomic Energy Community, Geel (Belgium). Central Bureau for Nuclear Measurements.
AN INTEGRATING STORAGE DISPLAY MONITOR WITH DARK-TRACE TUBE FOR NUCLEAR TWO-PARAMETER SPECTRA
D. Rieb and W. Stueber Sep. 1966 36 p refs
(EUR-3117.e) CFSTI: HC $2.00/MF $0.50

The necessity and possibility of a monitoring device for sorted display of unsorted nuclear event data during or after their recording on magnetic tape are discussed. A dark-trace storage tube is proposed for this purpose and the main characteristics of such a tube are studied. The operation and the circuits of a developmental storage monitor are described. The investigations have shown, that a sorting storage monitor unit is feasible, but that the dark-trace tube is not well suited because of its logarithmic integration characteristic. According to the published characteristics of charge picture storage tubes it is supposed that such a tube will give a much better result, and therefore an investigation of a charge picture storage tube with a nominal diameter of 10" is in preparation.
Author

N67-10631# Oak Ridge National Lab., Tenn.
THE SFR-3 CODE: A FORTRAN PROGRAM FOR CALCULATING THE FREQUENCY RESPONSE OF A MULTIVARIABLE SYSTEM AND ITS SENSITIVITY TO PARAMETER CHANGES
T. W. Kerlin and J. L. Lucius 30 Jun. 1966 30 p
(Contract W-7405-ENG-26)
(ORNL-TM-1575) CFSTI: HC $2.00/MF $0.50

A computer code was prepared for calculating the frequency response of a multivariable system and the sensitivity of this frequency response to parameter changes. The method provides sensitivity information by utilizing operators available from the usual frequency response calculation and the resulting increase in computing time required to obtain sensitivites over the time required to obtain the frequency response alone is insignificant. The FORTRAN IV listing is given along with a complete input description and a solved sample problem. Author (NSA)

N67-10651# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
SHUTDOWN: A REACTOR SHUTDOWN OPTIMIZATION CODE
J. R. Fredsall Mar. 1966 46 p refs
(AAEC-TM-314)

The FORTRAN IV digital computer code SHUTDOWN uses a trial and error procedure to find the optimum method of altering the reactor power before shutdown for an outage of a given desired duration. Exact optimum solutions are not found by this method but the solutions that are found can be used to improve reactor operations. Author (NSA)

N67-10658# Commissariat a l'Energie Atomique, Saclay (France). Service d'Instrumentation Nucleaire.
PROCESSING OF DATA ISSUED FROM A SPECTROMETER [TRAITEMENT DES INFORMATIONS ISSUES D'UN SPECTROMETRE γ]
Jean-Pierre Boulanger Mar. 1966 56 p refs In FRENCH
(CEA-R-2991)

A study was made of computation methods applied to analysis by gamma spectrometry. An investigation was made of quantitative analysis by the least-squares method, improved by a gain-shift correction. Then the single full-energy peaks and the resolution of complex peaks are dealth with. In both cases, the calculation principle, then the systematic tests realized in order to prove their validity and determine their application ranges are described and finally some experimental results appropriate to illustrate their possibilities are presented. Author (NSA)

N67-10686# Atomic Energy Establishment, Winfrith (England).
A DESCRIPTION OF THE ELAN COMPUTER CODE
E. J. Maunders Mar. 1966 20 p refs
(AEEW-M-621) HMSO: 3s

The ELAN code was developed for use in the field of integral neutron energy spectrum measurements. Two problems are dealt with, that of effective filter cut-off energies, and filtered detector reaction rates, and the problem of self-shielding in detectors. In the latter case routines are included which aid the design of sandwich foil packs which make use of self-shielding. Author (NSA)

N67-10704# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
SCATLD: A TAPE EDITING PROGRAMME FOR GYMEA NEUTRON SCATTERING LIBRARIES
B. Mc Gregor Jan. 1966 42 p refs
(AAEC/TM310)

SCATLD is a tape editing program used to load GYMEA neutron scattering libraries from cards, or from cards and another library. Whole libraries or selected sections can be printed or punched. Author (NSA)

N67-10736# Bettis Atomic Power Lab., Pittsburgh, Pa.
CRIB 1: A STEAM GENERATOR STABILITY ANALYSIS PROGRAM FOR THE PHILCO-2000 COMPUTER
M. A. Pulick and S. G. Margolis Dec. 1965 100 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-530) CFSTI: HC $3.00/MF $0.75

An analysis for a digital computer program to predict the steady-state recirculation ratio and the presence of hydrodynamic instabilities in a steam generator is presented. The salient features for this analysis are as follows: allows for variable flow area and flow direction, allows for two-phase flow phenomena by employing a Martinelli–Nelson slip model, allows for a variable water level, and allows for a detailed account of mass and energy transport in the downcomer, tube bundle, and riser region. A single sample problem for comparison between analysis and experiment is also presented. The sample problem is for a natural circulation test loop, for which published data were readily available. Although the loop geometry is simple, its configuration and operating conditions were similar to those normally encountered on the secondary side of a steam generator. As indicated by the results the agreement between the predicted and experimental results is good. Experience to date is insufficient to determine whether this type of agreement can be expected for other geometries and other operating conditions. The comparison does demonstrate, however, that the analysis is capable of predicting the steady-state recirculation ratio and the presence of hydrodynamic instabilities. Author (NSA)

N67-10761# Bettis Atomic Power Lab., Pittsburgh, Pa.
TRANS: A FORTRAN-IV PROGRAM FOR CONVERSION OF FORM OF NEUTRON ELASTIC SCATTERING DATA STORED IN THE ROC NUCLEAR DATA LIBRARY
D. R. Harris and C. B. Noll May 1966 20 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-573) CFSTI: HC $1.00/MF $0.50

TRANS is a FORTRAN-IV program for conversion of the form of neutron elastic scattering data stored in the ROC nuclear data library. The data are converted from any form found in the library into the form recommended for retrieval by neutron transport programs, viz., the form consisting of coefficients of Legendre polynomials in the center of momentum coordinate system. Optionally, data are converted to various forms required for comparison with measured and evaluated data. Author (NSA)

N67-10848# Sandia Corp., Albuquerque, N. Mex.
A PROCEDURE FOR THE COMPUTATION OF NEUTRON FLUX FROM FOIL ACTIVATION DATA: SPECTRA CODE
C. L. Greer and J. V. Walker Jul. 1966 17 p refs Presented at the Conf. on Radiation Meas. in Nucl. Power, Berkeley, England
(Contract AT(29-1)-789)
(SC-DC-66-1512; CONF-660911-2) CFSTI: HC $1.00/MF $0.50

A technique is presented for determining the differential flux from foil activation data. The differential flux is represented by a piece-wise linear function in energy and the foil activations equations are reducnd to a system of linear equations. An iteration algorithm, based on a minimization of a least squared error, is developed for solving the activation equations and the resulting infinite matrix series is solved explicitly. A computer code, SPECTRA, was written which incorporates the above technique, and which presently computes the differential flux at a maximum of fifty energy points. The code contains a cross section library of twenty-eight reactions and a complete data tape handling program which allows the removal, addition, and/or editing of the data on the cross section tape. Examples are presented which indicate that, with a

general knowledge of the spectral shape, one can obtain quite accurate spectral information from activation detectors.
Author (NSA)

N67-10974# Army Nuclear Defense Lab., Edgewood Arsenal, Md.
NEP-12, A COMPUTER PROGRAM FOR NUCLEAR EMULSIONS
Richard V. Mancuso and Austin W. Barrows Sep. 1966 24 p refs
(NDL-TM-34; AD-639048) CFSTI: HC $1.00/MF $0.50

A code is described which calculates neutron energy from knock-on proton track length and orientation in nuclear research emulsions. The code contains a sorting routine which sorts the neutron energies into preselected energy intervals, and a plotting routine which plots the neutron energy spectrum. The code may be used for any emulsion by calling the appropriate subroutine which contains the range-energy relation for the emulsion used. The program is applicable to any experiment where a neutron energy spectrum is desired. Author (TAB)

N67-10986# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
PROBLEMS IN NATIONAL LANGUAGE COMMUNICATION WITH COMPUTERS
Daniel G. Bobrow Aug. 1966 19 p refs
(Contract AF 19(628)-5065; ARPA Order 627)
(BBN-1439; AFCRL-66-620; SR-5; AD-639323) CFSTI: HC $1.00/MF $0.50

The paper gives an overview of the problems involved in the construction of a computer-based question-answering system designed to interact with the user in English. The system is viewed as containing five distinct parts - a parser, a semantic interpreter, an information storer, an information retriever, and an English output generator. There is a need for extensive interaction among these subsystems, and between the subsystems and the user. Examples are given of the type of processing done by each subsystem, and the nature of the possible interactions. The syntactic analysis described is based on a Chomsky type of transformational grammar. The semantic store is characterized by a form of the predicate calculus, with additional algorithms for computation, and structures designed for fast access to relevant data
Author (TAB)

N67-11068# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FERRITE CORE MEMORIES
Jozsef Drasny and Imre Molnar 11 Aug. 1966 25 p refs Transl. into ENGLISH from Mares Autom. (Budapest), v. 12, no. 6, 1964 p 189-195
(FTD-TT-65-1307; TT-66-62358; AD-639551) CFSTI: HC $1.00/MF $0.50

Translation of Hungarian research: ferrite core memories. TAB

N67-11076# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HOW ELECTRONIC COMPUTING MACHINES WORK
N. Kanivets 18 Apr. 1966 15 p Transl. into ENGLISH from Nauka i Tekhnika (Riga), no. 2, 1965 p 7-9, 31
(FTD-TT-65-1718; TT-66-62242; AD-638894) CFSTI: HC $1.00/MF $0.50

Translation of Russian article: how electronic computing machines work. TAB

N67-11094# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
USING TWO-DIMENSIONAL FILTRATION OF IMAGES TO INCREASE THE RELIABILITY OF AUTOMATIC READING
V. P. Romanov 17 Jun. 1966 14 p Transl. into ENGLISH from Inform. o Nauchn.-Issled. Rabot., Filial Vses. Inst. Nauchn. i Tekhn. Inform. (Moscow), no. 7, 1964 p 24-26
(FTD-TT-65-1894; TT-66-62352; AD-639490) CFSTI: HC $1.00/MF $0.50

Results are given of investigations of algorithms of the processing of images of machine recording signs, separation of edges and image angles, allowing one to realize suppression of noise, and also work results of separation algorithms of sign form elements - special points, rectilinear and curvilinear sections.
(Author)TAB

N67-11103# California Univ., Berkeley.
COMPUTER PROGRAMS FOR THE ANALYSIS OF AXISYMMETRIC EXTRUSIONS
A. Shabaik, C. H. Lee, and Shiro Kobat Jul. 1966 24 p
(Grant Nonr(G)-00020-66)
(TR-2; AD-637146) CFSTI: HC $2.00/MF $0.50

The use of a computer for calculating complete solutions of axisymmetric extrusions by the visioplasticity method was developed.
Author (TAB)

N67-11106# Stanford Univ., Calif. Dept. of Computer Science.
AN APPROACH TO COMPUTER LANGUAGE DESIGN
William M. Mc Keeman 31 Aug. 1966 124 p
(Contract Nonr-225(37))
(CS48; AD-639166) CFSTI: HC $4.00/MF $1.00

The problem of an extendable compiler is approached by attempting to simplify the methods of generating a compiler and by designing a basic language upon which to build. A context-free grammar is required as the initial input to a syntax preprocessor which produces syntactic analysis tables for the extendable compiler. A formal mathematical description of a class of analysis algorithms, two new syntax preprocessor algorithms, and theorems concerning the behavior of the algorithms and the nature of the acceptable grammars are given. The Euler development of Wirth and Weber (Euler: a generalization of Algol and its formal definition. Technical report, CS20) is carried to a more concise and powerful form. We advocate languages that are minimal and involuted. A minimal language combines into a single construct any two conceptually similar but notationally different constructs. An involuted language avoids constructs that are applicable only in local context. Control over the flow of execution within a program is obtained that is sufficiently complete so that the traditional label and go-to statement can be discarded as irrelevant. An extendable compiler is presented that is written in the kernel language itself. Conclusions are that the precedence grammar techniques are efficient and useful. Further improvement could make them substantially superior to other methods of compiler generation. Author (TAB)

N67-11128# Joint Publications Research Service, Washington, D. C.
COMPUTER ENGINEERING IN RAILROAD TRANSPORTATION
N. A. Feofanov and A. A. Puzina 31 Oct. 1966 11 p Transl. into ENGLISH of excerpts from the book 'Vychislitel'naya Teknnika na Zheleznodorozhnom Transporte'' Moscow, Transport Publ. House,1965 p 16- 23; 170-178
(JPRS-38395; TT-66-34821) CFSTI: $1.00

Mechanized bookkeeping and accounting operations are described with respect to labor and wages in the area of railroad transportation. The use of key-operated text calculators is advocated for small enterprises and organizations, and the economic effectiveness of mechanized accounting in railroads is considered. Areas of improved computer operation are listed as those of bookkeeping, statistical accounting, economic planning, and engineering calculations. An electronic multiplication attachment is described and its components are briefly enumerated. S.P.

N67-11138# Bell Telephone Labs., Inc., New York.
GRAPHIC 1–A REMOTE GRAPHICAL DISPLAY CONSOLE SYSTEM
William H. Ninke [1965] 8 p refs Presented at the Fall Joint Computer Conf., Las Vegas, Nev., Dec. 1965 Submitted for Publication
(MONOGRAPH-5113)

Graphic 1 provides flexible man-computer graphical communication in a time- shared central computer environment. Its console unit can be divided into two major units. The first unit consists of a control computer, which provides the local console computer power, and the console input devices. The second unit contains a display scope and an associated core buffer memory for storing display material. The main input device for the console system is a light pen. A standard teletype keyboard may also be used for input-output functions. Possible uses for the system are examined. H.S.W.

N67-11179# Naval Weapons Lab., Dahlgren, Va.
COMPUTER ASSISTED INSTRUCTION: A SELECTED BIBLIOGRAPHY AND KWIC INDEX
Gerald L. Engel and Wade J. Temple Aug. 1966 48 p refs
(K-49/66; AD-638892) CFSTI: HC $2.00/MF $0.50

Information on computer assisted instruction, including any means by which the educational processes are furthered by the use of a computer, are collected and catalogued in this annotated bibliography. The bibliography is referenced by a key word in context (KWIC) index, which was adopted to ease updating of the material and access by the users. Although the report confines itself primarily to the problem of tutorial interaction, the topics of programmed texts, teaching machines, and learning theory are also included. L.E.W.

N67-11196# Massachusetts Inst. of Tech., Cambridge. Electronics Systems Lab.
AN ANALOG PHOTORESISTIVE MULTIPLIER Final Report, May–Dec. 1965
Mark E. Connelly Wright-Patterson AFB, Ohio, AMRL, May 1966 50 p refs
(Contract AF 33(615)-2923)
(AMRL-TR-66-71; AD-638816) CFSTI: HC $3.00/MF $0.50

An inexpensive, yet accurate, analog multiplier producing seven products of a common variable has been developed and tested successfully. The device utilizes resistance variations in an array of eight photoresistive cells illuminated by a single incandescent lamp, the light level of which is controlled by the common multiplier. Three specific configurations are discussed in this report; two are four-quadrant multipliers and the third is a two-quadrant multiplier. The use of the latter in analog division is also treated. Static accuracies for the three configurations range from 0.1 percent to 0.25 percent relative to full-scale plus or minus 10 volts. The cell history, voltage, and temperature characteristics and the frequency response of the cell and lamp are discussed in detail. (Author) TAB

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N67-10025# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
AN ELECTRONIC PULSE MULTIPLIER FOR IDENTIFICATION OF CHARGED PARTICLES
A. Turos and A. Zieminski Mar. 1966 15 p refs
(INR-693/I/PL) CFSTI: HC $1.00/MF $0.50

A simple, low cost electronic pulse multiplier for identification charged particles with different mass and/or charge is described. The well known relation $4XY = /X+Y/^2 - /X-Y/^2$ is a basis for getting the product of two electrical signals. The square law operations on the /X+Y/ and /X−Y/ values are performed by specially developed diode square function generators. The circuit is capable of handling input pulses as narrow as 0.5/μsec with the accuracy of the product of 1%. Author (TAB)

N67-10099# United Kingdom Atomic Energy Authority, Risley (England). Reactor Engineering Lab.
STANDARD RELAY MODULES FOR SAFETY AND CONTROL CIRCUITS. PART I: GENERAL DESCRIPTION
B. J. Maple and A. G. Cooper 13 Jul. 1966 11 p
(TRG-933(R), Pt. I) CFSTI: HC $1.00/MF $0.50

A general description is given of the standard relay modules designed to meet the need for relay logic on experimental plant. The design can be constructed without prior knowledge of the plant requirements and can be made to suit a particular application by the simple expedient of arranging links in a removable connector. Author

N67-10102# Philco Corp., Lansdale, Pa.
RELIABILITY PHENOMENA IN ALUMINUM METALIZATIONS ON SILICON DIOXIDE
W. M. Berger, R. S. Keen, and G. L. Schnable *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 1–31 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 30(602)-3610)

Phenomena observed during operation life, and results of analysis of operating circuits using a high resolution thermal plotter as a tool to determine localized temperatures are discussed. The effects of storage life are reviewed, with a discussion of the phenomena involved. The limitations of aluminum metalization on silicon integrated circuits and devices are summarized and conclusions drawn relative to the mechanisms involved. Possible techniques for improving device or circuit reliability are outlined. Author

N67-10103# Lockheed Missiles and Space Co., Palo Alto, Calif.
THE ROLE OF METALLOGRAPHY IN THE ANALYSIS OF FAILURES OF ELECTRONIC COMPONENTS
William C. Coons *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 32–45 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

Suggested techniques for preparing microelectronic components for metallographic analysis are outlined. To illustrate the role of metallography in analyzing failures of electronic components, three examples are presented. The examples show the results of a nondestructive examination of a PbS infrared detector; a 90-degree cross section examination through gold to aluminum thermocompression bonds on silicon transistors; and taper section studies of gold, molybedum, and silica films on silicon substrates and of a gold to aluminum joint. R.N.A.

N67-10104# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
ANALYSIS OF SEVEN SEMICONDUCTOR METALLURGY SYSTEMS USED ON SILICON PLANAR TRANSISTORS
William H. Gianelle *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 46–57 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

Two metallurgical systems are recommended for improved reliability of silicon planar transistors. These comprise one each for SiO_2 protected transistors with extended and nonextended contacts. Wedge bonding versus ball bonding is discussed, an electrical failure is defined, and the failure mechanisms and/or potential problems of seven metallurgical systsms are discussed. For nonexpanded contact NPN SiO_2 transistors, the gold wire to aluminum land system is recommended. However, the amount of aluminum must be kept to a minimum to eliminate the formation of intermetallics under the bonds and the largest gold wire and ball thermocompression bonding should be used. For PNP transistors, the same system is recommended, but an N+ enhancement diffusion is needed in the base prior to the aluminum metallization to achieve a good ohmic contact. For expanded contact NPN or PNP SiO_2 protected transistors, the gold wire to molybdenum-gold land system is recommended. Again, an N+ enhancement diffusion is required in the base of the PNP transistors prior to metalization, and the largest gold wire and ball bonding should be used. R.N.A.

N67-10105*# General Electric Co., Philadelphia, Pa. Missiles and Space Div.

A TECHNIQUE FOR CONTROLLABLE ACCELERATION AND PREDICTION OF DEGRADATION MECHANISMS OF ELECTRONIC PARTS

M. Rocci (RADC) and T. Walsh *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 59–73 Supported in part by NASA (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75 (Contract AF 30(602)-3415)

The results of an accelerated test program on electronic parts and the use of the test data to predict the life characteristics of the parts are discussed. Examples are given to illustrate the analysis method used for combining the results of the various test phases into a stress versus expected life chart which may be used in designing long life equipment. The two general techniques used for the data analyses are described and data are given to illustrate each technique. Recommendations are also included for the design and analysis of future accelerated test programs. R.N.A.

N67-10106# Ministry of International Trade and Industry, Tokyo (Japan). Electrotechnical Lab.

CUMULATIVE DEGRADATION MODEL AND ITS APPLICATION TO COMPONENT LIFE ESTIMATION

Hiroshi Shiomi *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 74–94 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

The degradation accumulation principle and stress-time transformation of reaction theory are useful estimation tools of component life. The difference between failure rate acceleration factor and life acceleration factor is pointed out. Given the Weibull shape parameter m, two factors are related by $a\lambda = A_L^m$. The generalized cumulative degradation rule, $\Sigma(t_i/L_i) = 1$, is introduced. Using this rule, estimation and prediction of component life under successive different stress levels are possible both for drift and catastrophic failure. The advantage of the method is economic evaluation of component life by combining its past knowledge of life and stress history. Assuming the knowledge of drift pattern or shape of failure time distribution, 1nL : stress plot is estimated from the information of accumulated drift or failure versus stress plot obtained by one step stress experiment. Author

N67-10107# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.

THE APPLICATION OF FAILURE ANALYSIS IN PROCURING AND SCREENING OF INTEGRATED CIRCUITS

Jayne Partridge, Eldon C. Hall, and L. David Hanley *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 95–140 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

The procedure for testing, screening, and lot rejection of integrated circuits for the Apollo guidance and navigation computer is described. Based on a knowledge of failure modes, failure mechanisms, and contributing causes to failures in manufacturing, the method tries to increase integrated circuit reliability by screening and analyzing weak devices and using the generated data to quantitatively assess the lot for acceptance, rework, or rejection. Data are given showing variations among vendors and among procurement lots shipped from a single vendor. Factors contributing to the variations are discussed. The appended process documents include stress test procedures, failure mode classification, numerical rejection limits per class of failure modes, internal visual rejection criteria, and leak test procedures. The evolution of the process documents, which have the ultimate goal of eliminating or minimizing detected failure modes, is discussed. The described process is a continuous monitoring procedure for qualifying parts and vendors, and creates an incentive on the part of the vendor to eliminate causes of failures. R.N.A.

N67-10108# Bell Telephone Labs., Inc., Laureldale, Pa.

LIFE PREDICTIONS OF DIFFUSED GERMANIUM TRANSISTORS BY MEANS OF POWER STRESS

W. C. Gibson *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 140–155 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

A study was conducted to show the feasibility of power stressing germanium devices to obtain meaningful life predictions. The approach followed to achieve this objective was to insure that failure modes often observed when using power stress methods were not the result of inadequate or aging equipment, to secure a safe device operating range without introducing abnormal failures, to stress device samples based on these findings and predict device life, to compare the prediction with temperature stress life predictions of this and a similar device, and to comment on "in service" results. The study showed that meaningful predicted life expectancy of germanium devices can be determined from power stress results if test sets and aging facilities do not introduce failures, and if the safe device operating region is predetermined and operation is kept within this region. Power stress results for the germanium device yielded 2 magnitudes shorter life for a given temperature than did temperature stress results even after extensive precautions were taken to eliminate abnormal failure mechanisms. R.N.A.

N67-10109# Electrical Research Association, Leatherhead (England).

FAILURE MECHANISMS OF ELECTRONIC COMPONENTS

H. F. Church and B. C. Roberts *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 156–177 refs Supported by the Elec. Res. Assoc. and the Min. of Aviation (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

An attempt is made to summarize all known failure mechanisms which can affect conventional passive electronic components. The specific causes of component failure discussed include accidental damage during manufacturing or assembly; failure during storage; mechanical damage due to shock or vibration; mechanical wear; material instability which includes thermal instability, moisture effects, and material incompatibility; metal migration and electrolyte corrosion in the presence of moisture; electrochemical effects in the absence of moisture; surface failure (tracking); localized arcing initiated by mechanical defects; failure due to gaseous discharges; mould growth; and miscellaneous failures peculiar to particular components. The survey concludes that highly reliable electronic components are attainsble only if the causes of failure are understood and eliminated in advance by correct design and production control. A specified level of performance in short term tests cannot ensure reliability. Many of the conclusions reached, based on long term trouble shooting

experience and component testing, are of a basic nature and are likely to apply to the recent developments in electronic devices, especially microcircuits. R.N.A.

N67-10110# Philco Corp., Lansdale, Pa.
ACCELERATED AGING AND FAILURE MECHANISM ANALYSIS OF THIN TANTALUM FILM R-C NETWORKS
M. Walker, A. Mc Kelvey, G. Schnable, and M. Sharp *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 179–209 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 30(602)-3287)

Accelerated stress testing of tantalum thin film resistor-capacitor networks was conducted to establish a means of predicting use failure rates and determine major failure modes. Physical failure mechanisms were also studied. Simultaneous tests were made at both elevated and use voltages and temperatures. Relationships between accelerated stress and actual failure rates were investigated. The resulting failure modes include resistance changes and thermal runaway for resistors, and leakage current increases and dielectric breakdown for capacitors. Interaction rate plots of tantalum resistors with various gases were made at high temperatures. The Ta_2O_5 dielectric conduction mechanism studies indicated ionic conduction. Several methods for locating defects in the Ta_2O_5 capacitor dielectric films were evaluated; best results were obtained with a copper plating method. The tantalum thin film resistors are very reliable and the failure mechanisms are understood well enough to predict resistor reliability under various stress conditions. The thin film capacitors are reasonably reliable, but are the limiting factor in R-C network reliability. R.N.A.

N67-10111# Battelle Memorial Inst., Columbus, Ohio.
A TRANSIENT COMPONENT IN THE BREAKDOWN VOLTAGE OF SILICON p-n JUNCTION RECTIFIERS
H. C. Gorton *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 211–225 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

In a study of avalanche breakdown in diffused silicon p-n junctions, an exponential decrease with time has been observed in the onset voltage for microplasma conduction. The time constant of this decrease is inversely proportional to the ratio of average on- to off-time of the microplasma pulses, and the magnitude is temperature dependent, peaking at approximately 260°K. The theory is advanced that, during the avalanche pulse the acquisition rate of electrons by ionized donor impurities is increased, decreasing the ionized donor concentration, thus changing the field intensity and hence the breakdown voltage. In effect, compensating donor sites tend to fill during the microplasma pulses and empty in the intervals between pulses. At temperatures where the Fermi level is several kT from the energy level of the trapping sites, the occupation index of the traps is relatively unaffected by injected carrier density. However, where E_F is within a few kT of E_T, the occupation density of the traps is a strong function of the injected carrier density. Author

N67-10112# Radio Corp. of America, Somerville, N. J.
ELIMINATION OF FORWARD-BIASED SECOND BREAKDOWN BY RESISTIVE BALLASTING OF SILICON POWER TRANSISTORS
Daniel Stolnitz *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 227–241 (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

The failure of power transistors by second breakdown resulting from severe nonuniformities in current density is discussed. A solution to the nonuniformities of current density consists of dividing the emitter region into many small discrete areas and placing a limiting debiasing resistance in series with each one. A continuous distributed resistance in series with an undivided emitter can also be used. In either case, an excess of current to any subregion produces a larger voltage drop across the resistance in series with that area and reduces the forward bias applied. The effect of this resistive ballasting on forward biased second breakdown was studied experimentally using a modified triple-diffused silicon power transistor which employs an interdigitated contact geometry. To demonstrate the improvement obtainable with ballasting resistors, tabulated data are given showing the change in second breakdown-free power. Current hogging and base source impedance causes of second breakdown are also treated. R.N.A.

N67-10113*# Westinghouse Corp., Pittsburgh, Pa. Research Labs.
FAILURE OF LARGE-AREA EPITAXIAL-DIFFUSED SILICON DEVICES
T. L. Chu and P. J. Kannam *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 242–257 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contracts NAS8-11432; NAS8-5335)

The structural perfection of the epitaxial diffused silicon films is an important factor determining the performance and reliability of large area epitaxial diffused devices. Their characteristics are affected by imperfections generated during the epitaxial growth and diffusion processes. Common imperfections in epitaxial silicon films are dislocations, stacking faults, growth pyramids, and polycrystalline inclusions. Except for those propagated from the substrate, structural imperfections in these films can be eliminated by using proper growth techniques. The diffusion of high concentrations of dopants into epitaxial silicon films generates dislocations and transforms stacking faults into other types of imperfections. Localized areas of high dislocation density in the films, due to contamination and improper handling techniques, are responsible for the softness of large area epitaxial diffused junctions. The characteristics of these junctions are improved by using a gettering technique. The epitaxial growth technique is a valuable substitute for diffusion in reducing the failure of certain large area devices. Author

N67-10114# Texas Instruments, Inc., Dallas.
A LIMITATION TO THE STEP STRESS TESTING CONCEPT FOR INTEGRATED CIRCUITS
W. Shurtleff and W. Workman *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 258–278 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

Reliability information for integrated circuits is extremely difficult to obtain. Process improvements and major breakthroughs in the state of the art have pushed the reliability of integrated circuits extremely high. Reliability engineers must depend on accelerated life testing to obtain the required reliability information. There are limits to accelerated life testing which, if exceeded, preclude the possibility of obtaining useful data. Simple laboratory tests, such as those described, on a few devices can reveal the onset of these limitations and allow the maximum information to be obtained. Author

N67-10115# Texas Instruments, Inc., Dallas. Central Research Labs.
THERMOPHYSICS OF SILICON POWER TRANSISTORS
David A. Peterman *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 279–290 ref (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 30(602)-3727)

This paper describes a study of the fundamental thermophysics of silicon epitaxial power transistors with emphasis on obtaining quantitative agreement between analytical calculations of junction temperature variations and experimental temperature profiles obtained with an infrared microradiometer. These temperature distributions are a prime manifestation of thermal-electrical interactions which affect the performance and reliability of the device. Obtaining quantitative agreement requires an accurate model

representing the heat conduction problem, a realistic energy dissipation distribution for correct boundary conditions, and accurate experimental temperature profile data. A commercial NPN silicon epitaxial power transistor was chosen for detailed study. Author

N67-10116# ITT Federal Labs., Palo Alto, Calif. Semiconductors Product Labs.

ACCUMULATION AND DECAY OF MOBILE SURFACE CHARGESON INSULATING LAYERS AND RELATIONSHIP TO RELIABILITY OF SILICON DEVICES

W. Schroen *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 291–314 refs Supported by RADC (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

Reverse biased diodes of various geometrical dimensions, oxide preparation techniques and breakdown voltages were used to measure surface contact potential differences and surface ion distributions in various ambients. The experimental data of ion accumulation were compared to complementary error function solutions expected for a distributed capacitance and sheet resistance. After bias removal the accumulated positive and negative charges were allowed to decay. Significant differences of decay times could be observed determined by the sign of the charge and the chemical preparation of the sample. The influence of mobile surface charges on device characteristics, particularly on the diode breakdown voltage, is described. The relationship between the surface breakdown voltage and the external bias applied to a metal strip located geometrically above the p-n junction is established. Finally, it is shown that a "freezing" of the surface charges can change and stabilize the diode V-I characteristics considerably. Author

N67-10117# Fairchild Semiconductor Corp., Palo Alto, Calif. Research and Development Lab.

MECHANISMS OF CHANNEL CURRENT FORMATION IN SILICON p-n JUNCTIONS

D. J. Fitzgerald and A. S. Grove *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 315–332 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

The physical mechanisms of the formation of channel currents associated with reverse biased P-N junctions are studied in detail. It is demonstrated that a channel characteristic results when a site of very high carrier generation rate is connected by an inversion layer to the P-N junction. Such sites are shown to be due either to a fault associated with the field-induced junction between the inversion layer and underlying silicon, or to the breakdown of this junction. Author

N67-10118# Rome Air Development Center, Griffiss AFB, N. Y.

EFFECT OF AMBIENT ON BREAKDOWN OF SILICON p-n JUNCTIONS

John F. Carroll *In its* Phys. of Failure in Electron, Vol. 4 Jun. 1966 p 333–344 (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

Although microplasma breakdown considerably below bulk breakdown in reliable devices has been reduced by design techniques, devices still remain in which the design techniques cannot be used or those in which the design techniques themselves can be the cause of high leakage or premature breakdown due to defects. A study was conducted to show that surface effects can significantly affect preferential breakdown near the surface. Small defects near the surface with high limiting resistance can cause significant change in the reverse current at both low voltage and near breakdown with a change in surface condition. They can be distinguished from large defects or normal breakdown of the junction by their high limiting resistance after breakdown. If their breakdown is near bulk breakdown or above, light emission will not be observed. If the defect is in a channel, it will not produce visible emission unless it is close to the metallurgical junction due to the series resistance of the channel. Point defects in the metallurgical junction region provide a means of determining the field configuration on the basis of their light emission characteristics after breakdown when the surface condition is changed by the drift of ions in the oxide or charge motion on the surface. R.N.A.

N67-10119# Sprague Electric Co., North Adams, Mass. Research and Development Labs.

SURFACE LEAKAGE OF DIELECTRICS

L. Fedotowsky, P. Ho, and K. Lehovec *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 345–353 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

The surface leakage resistance, R_s, of silicon oxide, and its bulk leakage resistance, R_b, in humid ambients are determined from charging and discharging curves of MOS capacitors. Using these data we derive the extension of creep of surface charges from an electrode to which a d.c. voltage is applied. This creep which may induce breakdown phenomena in oxide-covered silicon microcircuits is retarded by reducing thickness and bulk resistance of the oxide. Author

N67-10120# Litton Systems, Inc., Woodland Hills, Calif. Guidance and Control Systems Div.

A SIMPLE TECHNIQUE FOR THE DIRECT OBSERVATION OF TEMPERATURE DISTRIBUTION IN MICROELECTRONIC STRUCTURES

Donald W. Howarth *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 354–366 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

A simple technique has been developed to evaluate temperature distribution and heat flow, and to estimate thermal impedance in thin film resistor arrays and in integrated circuit structures. The technique, which is best suited for planar structures, consisted of coating the surface of the device with a thin layer of a birefringent organic material which has a sharply defined relatively low melting point. Power is applied to the device in slowly increasing steps. As local temperatures at the device surface reach the melting point of the material coating the surface, a line separating the liquid and solid phases of the material is easily observed through a microscope, using polarized illumination. The line traces an isothermal contour on the device surface, is sharply defined, and changes position on the surface as heat dissipation in the device is changed. The technique is easy to apply, and provides direct observation of temperature as a function of power dissipation over an entire surface with extremely fine resolution. R.N.A.

N67-10121# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

THE ROLE OF MICRODEFECTS IN SILICON STARTING MATERIALS AS QUALITY REDUCING FACTORS IN SEMICONDUCTOR DEVICES

J. W. Faust, Jr., H. F. John, and R. Stickler *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 367–378 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75 (Contract NAS8-11432)

Transmission electron microscope studies have shown that commercial silicon materials have varying concentrations of microdefects not detectable by normal evaluation procedures and ranging in size from less than 100 Å up to microns. Defects found include small and large loop shaped defects, inclusions, and precipitates. Their widespread occurrence in silicon emphasizes the need for developing improved materials growth techniques and rapid detection procedures. The frequency of occurrence of the various microdefects differs with the material; however, crystals grown by float-zone, Czochralski, and crucibleless pulling techniques did not differ significantly in the degree of the overall microdefect problem. Microdefect effects on devices depend on

the defect's nature and size, and whether it is conducting, nonconducting, or purely crystallographic. The defect's size is important in determining the device behavior under electrical stress and during long time operation. Qualitative relationships between microdefects and the quality of p–n junction devices have been established. R.N.A.

N67-10122# General Telephone and Electronics Labs., Inc., Bayside, N. Y.
STRUCTURAL DEFECTS AND JUNCTION CHARACTERISTICS IN SILICON TRANSISTORS
P. Wang (Sylvania Elec. Prod., Woburn, Mass.) and E. D. Jungbluth *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 379–389 refs Prepared in Cooperation with Sylvania Elec. Prod., Woburn, Mass. (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

Evidence relating crystal imperfections to processing treatments is presented and the effect of process-introduced dislocations on device yield in NPN silicon epitaxial planar transistors is demonstrated. To follow the generation of imperfections in device processing and to correlate device performance with the presence of imperfections, the nondestructive technique of X-ray diffraction microscopy was used to record large area topographs of whole crystal wafers at each stage in their fabrication. By knowing the locations of the dislocations, the sample can be probed in specific areas to characterize the electrical properties of transistor devices coinciding with high defect versus low defect areas. The method also establishes at once which processing step introduced dislocations or lattice strains. The concomitant strain fields associated with lattice perturbations are revealed as localized regions of enhanced X-ray intensities in the X-ray diffraction topographs. The visibility of dislocations depends on the choice of reflecting crystallographic planes. R.N.A.

N67-10124# Philco Corp., Blue Bell, Pa. Applied Research Lab.
RADIOCHEMICAL STUDY ON LATERAL ION MIGRATION IN INSULATING SUBSTRATES FOR THIN FILM MICROCIRCUITS
S. S. Choi *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 408–421 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 30(602)-3287)

Autoradiographic techniques are used to study lateral migration of sodium in insulating glass substrate for microcircuits. NTB plate and AR10 strapping film can be used for this purpose. In this work, the visual evidence has been established that sodium does in fact move laterally in insulating glass substrate under the influences of an electrical field in certain ambient conditions. The direction of migration of sodium is the same as that of the electrical field as is to be expected. Use of the stripping film technique, which involves processing emulsion in permanent contact with the sample, provides an excellent basal index of measurement. Because of the high resolution obtainable, and the inherent high sensitivity of detection, the technique should prove useful in allied fields. For the systematic study of ion migration phenomena in insulating substrates, work is underway using radioactive sodium prediffused material as the substrates. Author

N67-10125# Rome Air Development Center, Griffiss AFB, N. Y.
MINUTEMAN II, PHYSICS OF FAILURE PROGRAM—OPENING REMARKS
J. F. Wiesner *In its* Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 423–427 (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

The Component Quality Assurance Program was conducted to improve the reliability of the Minuteman II weapon system. Because life testing was impractical, the program applied various step stresses such as temperature, voltage, heat, vibration, etc., to uncover weak links in the device construction or fabrication techniques. Corrective actions were then applied in the form of design, material, or process changes. The Physics of Failure Program was set up to identify the causes and mechanisms underlying the failures uncovered by the application of the step stresses. Some of the general features of these two interrelated programs are discussed. R.N.A.

N67-10126# Autonetics, Anaheim, Calif.
FAILURE MECHANISMS ASSOCIATED WITH THERMOCOMPRESSION BONDS IN INTEGRATED CIRCUITS
G. V. Browning, L. E. Coltéryahn, and D. G. Cummings *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 428–446 (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 04(694)-247)

An investigation was conducted to determine the cause of failures encountered in gold-aluminum thermocompression bonds between gold wire and aluminum metalization on SiO_x-silicon dice in integrated circuit devices. The gold-aluminum interconnects in integrated circuit devices were found to display a time-temperature dependent mode of failure. This is the result of an interdiffusion of gold and aluminum and the tendency to form gold rich intermetallic compounds at elevated temperatures. There are some indications that air treatment causing oxidation of the pad and the associated circuitry has some retarding effect. The use of other metals, such as molybdenum, to act as diffusion barriers further retards interdiffusion. Temperature variation, static charges, and normal operating voltages can cause intermittent closure of open bonds. R.N.A.

N67-10127# Autonetics, Anaheim, Calif.
FAILURE MECHANISMS ASSOCIATED WITH THE THERMALLY INDUCED MECHANICAL STRESS IN MINUTEMAN DEVICES
C. G. Jennings *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 447–463 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 04(694)-247)

Metallographic examination of power transistors exposed to a selected assortment of thermal conditions indicated that their failure modes were associated with thermally induced mechanical stress. The evidence of plastic flow and abnormalities, also observed by metallographic examination, led to the postulation of three dependent failure mechanisms: 1) thin brazements between die and pedestal, and pedestal and header reduce plastic flow capability, 2) thermal cycling of devices as a screening technique causes strain aging in the brazement, and 3) nickel-silicon intermetallic formation reduces the strength and/or plastic flow capability of the brazement. Experiments are described which demonstrated the effect of thermally induced mechanical stress as an underlying failure mechanism in several semiconductor devices. The stress superimposes on other residual fabrication and service stresses to give a total composite stress. For the normal high reliability device, this stress is not sufficient to cause failure. However, when coupled with the above mentioned dependent failure mechanisms, it produces failures of significant importance in high reliability systems such as Minuteman. R.N.A.

N67-10129# Autonetics, Anaheim, Calif.
INVESTIGATION OF SURFACE FAILURE MECHANISMS IN SEMICONDUCTOR DEVICES BY ENVELOPE AMBIENT STUDIES
G. V. Brandewie, P. H. Eisenberg, and R. A. Meyer *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 493–521 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 04(694)-247)

A method was developed to analyze the gas ambient of good and failed semiconductor devices by use of a mass spectrometer with a mass range of 1 to 1400 and a unit resolution at mass

700. Techniques were developed so that the device junction would not be destroyed when the package was opened. Electrical measurements were made before, during, and after removal of the ambient and after back-filling with selected ambients. Other techniques were developed using the gas chromatograph for analysis. Several examples in which device package gas ambients were an important factor regarding the failure mechanisms are described. A survey of Minuteman II transistor and integrated circuit package ambients indicated that the gases present are a result of the manufacturing processes and are not well controlled. R.N.A.

N67-10130# Autonetics, Anaheim, Calif.
IMPERFECTIONS AND IMPURITIES IN SILICON ASSOCIATED WITH DEVICE SURFACE FAILURE MECHANISMS
J. E. Forrester, R. E. Harris, J. E. Meinhard, and R. L. Nolder *In* RADC, Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 522–560 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 04(694)-247)

An investigation concerned with the structural characterization of silicon device malfunction originating at or near surfaces and interfaces is described. Consideration was given to inversion phenomena associated with ionic redistribution in dielectric layers, and silicon crystal imperfections situated at or near the silicon–silicon dioxide interface. Inversion effects were examined in relation to junction spreading using electron beam microprobe technique, reverse current leakage, 1/f noise, and the kinetics of ion redistribution in the oxide layers of planar transistors. A tentative chemical bond model was evolved to explain the observed effects. Silicon crystal imperfections were examined by transmission electron microscopy and correlated in part with phosphorus doping profiles obtained by electron beam microprobe analysis. The experiments were conducted on planar power transistors and revealed line dislocations in the region of P–N junctions and other types of defects in the vicinity of the silicon–silicon dioxide interface. R.N.A.

N67-10131# Autonetics, Anaheim, Calif.
DESIGN AND PROCESS CONTRIBUTION OF INHERENT FAILURE MECHANISMS OF MICROMINIATURE ELECTRONIC COMPONENTS FOR MINUTEMAN II
A. J. Borofsky and D. C. Fleming *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 561–595 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contracts AF 04(694)-247; AF 04(694)-626; AF 04(694)-402)

High-stress testing of 200,000 microminiature components used on Minuteman II, and subsequent analyses of failures, have demonstrated deficiencies in design and processing of these microminiature components. These tests and analyses were made during the course of the Component Quality Assurance and Component Evaluation Programs. A summary of these results is given. It provides criteria for establishment of designs and processes for microminiature transistors, diodes, capacitors, resistors and integrated circuits. Solutions for demonstrated deficiencies are identified and categorized in terms of design improvement, process and tool changes, inspection changes, and screens. The role of component procurement documents and component qualification procedures in the assurance of proper design and processing of high reliability microminiature components is discussed. The effectiveness of these procedures in elimination of design and process inherent failure mechanisms is shown. Author

N67-10132# Boeing Co., Seattle, Wash. Aero-Space Div.
SELECTIVE CHROMATE CONVERSION OF INTEGRATED CIRCUIT INTERCONNECTING ALUMINIZATION
D. A. Abdo *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 597–608 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75

A nondestructive chemical process, chromate conversion of the interconnecting aluminization, was studied. The process reacts selectively producing striking contrasts in the color of the aluminization. Factors in the solution and integrated circuit itself influence the reaction rate. By proper application and technique, chromate conversion can locate sites of surface defects and attendant electrical failure. Variations and contrasts in the characteristic brown color show whether an area is P or N, the relative doping level, areas of high Al_2O_3 concentration, the presence of pinholes in the oxide under the aluminum, breaks in the aluminum, and contaminants on the surface. The process is simple, economical, has sharp color variations, and is nondestructive. Compositions of the various solutions and the pertinent reaction parameters are described. Factors within the integrated circuit affecting the reaction were studied. A proposed reaction mechanism is discussed. The process has great application as an analytical tool and as a process step for protecting aluminum against oxidation and mechanical damage. Author

N67-10133# Army Electronics Command, Fort Monmouth, N. J.
HOT SPOT MESOPLASMA FORMATION IN SILICON PLANAR TRANSISTORS
E. M. Hakim *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 609–619 refs (See N67-101-01 01-34) CFSTI: HC $9.65/MF $2.75

A model is presented to explain the cause of mesoplasmas when secondary breakdown occurs in silicon planar transistors. An analysis of both aluminum and gold metalized devices is presented. To substantiate the model, data are presented from experiments to analyze the second breakdown sites. Three areas of investigation are suggested which may prove effective in reducing the destructive effects of hot spots and mesoplasmas in transistors. Author

N67-10134# Autonetics, Anaheim, Calif.
FAILURE MECHANISMS ASSOCIATED WITH DIE-TO-HEADER BONDS OF PLANAR TRANSISTORS
J. D. Guttenplan and F. H. Stuckenberg *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 620–648 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 04(694)-247)

Five thermally induced physical processes that occur in die-to-header bonds in planar transistors were inestigated. These processes include solid state diffusion of intermediate materials into the bonding layer and outgassing of materials on the header, both resulting in void formation; nickel–silicon intermetallic formation leading to cracking; thermal reordering of gold-silicon eutectic alloys accompanied by electrical resistance changes; and a phase transformation in copper-gold braze alloys, also resulting in changes in electrical resistance. Kinetics of these processes were examined with relation to actual device materials and geometries to determine their effects on transistor electrical characterisitcs. Results indicate that the processes are probably not major life controlling mechanisms. However, any one or a combination of them may result in parameter drift and incipient failure during extended device operation. Thermal stabilization or outgassing steps in the device fabrication and close control of materials are suggested as corrective actions to prevent these deleterious effects. R.N.A.

N67-10327# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn. Electronics Dept.
HIGH RELIABILITY MICROCIRCUIT MODULES Interim Report, 1 Jun. 1964–31 Jan. 1966
A. R. Riben and R. E. Antalik Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 89 p refs
(Contract DA-28-043-AMC-00131(E))
(HSER-3149; ECOM-00131-1; AD-637819) CFSTI: HC $3.00/MF $0.75

Reliability of the Hamilton Standard MicroCircuit Module was studied. MicroCircuit Modules containing only transistors, containing transistors and thin film resistors and capacitors and containing functioning circuits (both hybrid and monolithic circuits) were studied. The tests consisted of high temperature storage, thermal cycling and mechanical environmental stress. The results of these tests were compared to the results of similar tests on identical transistors (fabricated in the same diffusion run) packaged in TO-18 cans. The study showed that the microcircuit module packaging scheme is as reliable as the TO-18 can. More specifically, it was found that the failure rate for transistors packaged in the microcircuit module and stored at 150C was 0.028%/1000 hours. The effect of the formation of gold-aluminum intermetallic compounds at the junction of gold leads and aluminum contact films is discussed. It is shown that proper process control can reduce but not eliminate this effect. This study has shown that highly reliable hybrid and monolithic circuits can be packaged in the Hamilton Standard MicroCircuit Module, offering substantial weight and volume reduction for complex electronic systems
Author (TAB)

N67-10331# Hughes Aircraft Co., Newport Beach, Calif. Electronic Devices Dept.
COLDWELD HI RELIABILITY QUARTZ CRYSTAL UNITS CR-1018 AND CR-65/U First Quarterly Progress Report, 25 Feb.–25 May 1966
William J. Garland 25 May 1966 26 p
(Contract DA-36-039-AMC-06179(E))
(Rept.-1; AD-638236) CFSTI: HC $1.00/MF $0.50

Holder parts of the HC-6 Coldweld type are available. The procurement and/or fabrication of special fabrication equipment is proceeding in a satisfactory manner. Process improvements of the lapping, etching, base coating and handling of the resonators has been incorporated in the fabrication procedures. Resonators are now being fabricated using the improved processess. Resonator designs have been initiated and little difficulty is expected in meeting the general specifications with the exception of the 1.0 MHz unit type CR-1018.
TAB

N67-10350# Lincoln Lab., Mass. Inst. of Tech. Lexington.
HIGH SPEED TUNNEL DIODE TRANSISTOR MICROLOGIC CIRCUITS
Yohan Cho 20 Jul.-1966 96 p refs
(Contract AF 19(628)-5167)
(TN-1966-17; ESD-TR-66-397; AD-637815) CFSTI: HC $3.00/MF $0.75

A set of logically flexible digital building blocks capable of implementing various logic functions with delays of less than one nanosecond was developed and fabricated in microcircuit form. The set consists of two basic types of circuit modules; with these, all conceivable digital system logic functions can be implemented. Tunnel junction diodes and silicon transistors provide gating functions, and a universal amplifier circuit module reshapes signal waveforms, restores amplitudes, and stores signals (flip-flop operations). Subnanosecond switching time is achieved by the effective utilization of a tunnel diode transistor circuit and hybrid integration techniques for microcircuit fabrication. The circuit provides the following characteristics: (1) low power delay time product (efficient switching); (2) effective noise immunity; (3) well-defined temperature invariant transfer characteristics; (4) relaxed component tolerances as compared to other tunnel diode logic circuits; (5) high fan-in and fan-out ratios; and (6) capability of performing all logical functions with two basic circuit configurations. The circuits were developed primarily for a high-speed digital system operated at a 100- to 200Mcps clock rate with a low impedance transmission line signal distribution scheme. Analysis of the circuit, optimization of the circuit characteristics, fabrication techniques of the circuit modules, and experimental results in a high-speed digital system are discussed
Author (TAB)

N67-10370# Piezo Crystal Co., Carlisle, Pa.
PEM QUARTZ CRYSTAL UNITS, FILTER LOW FREQUENCY 1 mc TO 10 mc TYPES CR-(XM-49)/U THRU CR-(XM-52)/U PER SCS-191 DATED 23 JANUARY 1963 Quarterly Progress Report, Jan.–Mar. 1966
Anthony S. Matistic 15 Jul. 1966 16 p
(Contract DA-36-039-AMC-03635(E))
(QPR-7; AD-638317) CFSTI: HC $1.00/MF $0.50

Crystal designs and processes are described for filter crystal units - frequencies 1.75 MC, 5 MC, 6 MC and 10 MC - which were fabricated for end use as Preproduction Samples. Three designs were selected to cover the comparatively broad frequency range: planoconvex at 1.75 MC, mass loaded flat round blanks at 6 MC and 10 MC, and mass loaded race-track shaped blanks at 5 MC. All major tests were performed. Performance was satisfactory at frequencies 5 MC, 6 MC and 10 MC. The preproduction samples were not submitted because of a capacitance ratio problem at the 1.75 MC frequency (planoconvex design)
Author (TAB)

N67-10375# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
PRODUCTION ENGINEERING MEASURE HIGH SPEED SEMICONDUCTOR SWITCH (TWO TERMINAL) AND HIGH SPEED SEMICONDUCTOR SWITCH (GATE) Quarterly Report, 28 Feb.–29 May 1966
Robert Burlingame 29 May 1966 26 p
(Contract DA-36-039-AMC-01475(E))
(QR-12; AD-637205) CFSTI: HC $1.00/MF $0.50

The report presents the results obtained from preproduction testing of three device types, details of circuitry considerations of turn-on time measurements, results of investigation of gate-cathode impedance of the 2N1765 device type, and evaluation of 3-terminal reliability and 2-terminal dv/dt problems. Preliminary investigation of producing a device with electrical characteristics similar to the 2N1765 but housed in a 7/16 inch stud package was performed and the results are reported
Author (TAB)

N67-10406# IRC, Inc., Philadelphia, Pa.
RELIABLE, LOW COST, STABLE RESISTOR GENERAL PURPOSE Final Progress Report No. 12, 1 May 1963–30 Apr. 1966
Mark J. Franceschini and Sylvester J. Mattie Ft. Monmouth, N. J., RADC, Sep. 1966 177 p refs
(Contract DA-36-039-AMC-02202(E))
(ECOM-02202-F; AD-638001) CFSTI: HC $5.00/MF $1.00

Because of specific problems in the Rv and L07 resistors, a third unit was implemented. This was designated as the Rg resistor. It consists of the desirable design and processing factors of the two previous units. Considerable testing on the unit has demonstrated its capabilities in meeting the contractual requirements of this task. It has the commercial availability of the MIL-R-11 composition unit. The testing program included MIL-R-11 tests, Temperature-Load Matrix tests, Moisture Load tests, and Accelerated Moisture Load Tests. A failure analysis was performed on the results of each of these tests. A degradation model, based on chemical kinetics, has been derived from the constant stress temperature-load data for six resistance values. A paper study was performed which indicated the feasibility of the manufacture of an 1/8 watt unit capable of meeting the same failure rate objectives as those listed in the Technical Guidelines of this contract
Author (TAB)

N67-10455# Army Electronics Labs., Fort Monmouth, N. J.
PREPARATION OF THIN-FILM TUNNELING STRUCTURES
Stanley Cabell and Dietrich Dobischek Aug. 1966 28 p
(ECOM-2718; AD-638416) CFSTI: HC $2.00/MF $0.50

Vacuum deposition techniques were developed for the preparation of thin-film metal-insulator-metal structures, and the tunneling capabilities of these structures were explored by testing them

for their V-I characteristics. The structures primarily investigated were Al-SiO-Al and Al-SiO-Au structures. A limited number of experiments were performed with Al-Al_2O_3-Al samples. Various methods described in detail in the report were used for forming the films. The thickness of the films was monitored using a laboratory-made quartz crystal oscillator as well as a commercially available instrument. Automatic control of the deposition rate and the thickness of the films was attempted and the reliability of the method explored. The Al-Al_2O_3-Al structures showed poor results when tested for their V-I characteristics. The breakdown strength of the samples was insufficient. Applied voltages of only a few tenths of a volt caused instant dielectric breakdown. Far better results were obtained with the structures in which SiO served as the insulator. The best structures displayed stable, tunneling-like V-I characteristics. Also, the lifetime of the devices was improved. Author (TAB)

N67-10495# Radio Corp. of America, Camden, N. J.
THE REGENERATIVE CERENKOV MICROWAVE INTERACTION Final Report, Feb. 1965–May 1966
A. Boornard, J. M. Brumbaugh, J. J. Stekert et al Griffiss AFB, N. Y., RADC, Aug. 1966 133 p refs
(Contract AF 30(602)-3061)
(RADC-TR-66-401; AD-638477) CFSTI: HC $4.00/MF $1.00

The microwave power generated by the Cerenkov interaction between a density modulated electron beam and two different types of regenerative Cerenkov couplers is measured. One is a resonant coupler while the other is non-resonant traveling wave coupler. The couplers are composed of uniform dielectric bars of rectangular cross section and having a dielectric coefficient of 15 at the operating frequency of 6.24 GHz. Typical experimental parameters are: dc beam current, 0.43 to 0.45 mA; gun voltage plus potential well voltage, 72.3 kV; and beam-to-dielectric separation, 0.134 cm. For the resonant regenerative coupler the generated microwave power was between 5.1 and 6.1 milliwatts, yielding an interaction resistance per unit length of between 3,200 and 3,900 ohms/cm. This may be compared to the traveling wave Cerenkov coupler for which the generated power was 1.8 to 2.4 milliwatts leading to an interaction resistance per unit length of between 730 and 970 ohms/cm. The power generated by the resonator is calculated to be about 3.7 times greater than that of the traveling wave coupler which compares favorably with the measured value of between 2.1 and 3.4. A self-consistent field analysis of the regenerative Cerenkov interaction between a modulated electron beam and partially dielectric loaded cylindrical waveguide is performed. Comparison is made with, a) the results obtained from a Pierce analysis of the same structure, and b) the results of a Pierce analysis for a typical helix structure. (Author) TAB

N67-10504# Ballistics Research Labs., Aberdeen Proving Ground, Md.
A BROAD RANGE MAGNETIC NEUTRON SPECTROMETER
Carmen M. Cialella May 1966 42 p refs
(BRL-MR-1753; AD-638137) CFSTI: HC $2.00/MF $0.50

A broad range, low deflection, magnetic neutron spectrometer was designed and constructed to measure the neutron spectra from pulsed and steady state sources. The instrument will cover an energy range of 0.5 to 17 Mev with a single magnetic field setting and is designed to provide energy resolution of approximately 10 percent. A collimated beam of neutrons is allowed to impinge on a thin polyethylene radiator producing recoil protons. A small forward cone of these protons, corresponding to the full energies of the incident neutrons, enters the magnetic field. The protons are analyzed and focused at a point outside the magnetic field. The focal line is straight and forms an angle of 10 degrees with the pole-piece edge. With 6 Mev neutrons, a 0.001 inch radiator, and a 0.5 inch slit width, the energy resolution is 7.7 percent and the efficiency is 6.3 x 10 to the -8th power counts per incident neutron Author (TAB)

N67-10515# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A RASTER SCAN CHARACTER GENERATOR FOR FACSIMILE ANNOTATION
Richard A. Ashwick (M.S. Thesis–George Washington Univ.) Jun. 1966 78 p refs
(Contract NOw-62-0604-c)
(TG-831; AD-638022) CFSTI: HC $3.00/MF $0.75

Paper describes a solid state Raster Scan character generator designed to print alpha numeric data on a picture produced electrically on a commercial facsimile machine. The character generator employs monolithic logic elements and a permanent data storage magnetic rope memory. The device generates 16 characters but may be easily expanded to generate a larger character set. A manual control permits variation of character size. Theory of operation and design details are presented. Resultant prints of characters and character generator annotated pictures are displayed Author (TAB)

N67-10516# Rome Air Development Center, Griffiss AFB, N. Y. Research and Technology Div.
DEVELOPMENT OF I/P BRACKET DECODE CHANGE KIT Technical Report, Aug. 1965–Feb. 1966
Paul Brown Aug. 1966 34 p
(RADC-TR-66-453; AD-638612) CFSTI: HC $2.00/MF $0.50

The purpose of the report is to describe an Identification of Position (I/P) fix. Such a fix is needed to enable military decoders to process the two different methods of I/P reporting currently in use. This fix, called the I/P Bracket Decode Change Kit, provides the AN/GPX-8A and the AN/GPX-9B Identification Friend or Foe (IFF) equipment with Air Traffic Control Radar Beacon System/IFF/Mark XII System (AIMS) I/P decode capability. Both physical and electrical solutions have been worked out for the above units. The I/P Bracket Decode Change Kit has been tested in the AN/GPX-8A by both the Air Force and the Navy, and in the AN/GPX-9B by the Air Force. It was shown to be a satisfactory solution to the I/P problem and, as such, is currently being implemented. Author (TAB)

N67-10519# Polytechnic Inst. of Brooklyn, N. Y. Electrical Engineering Dept.
FEEDBACK—PAIR DESIGN PROCEDURE
Laurence Milstein Jun. 1966 51 p
(Contract AF 49(638)-1402)
(PIBMRI-1324-66; AD-638457) CFSTI: HC $2.00/MF $0.50

The report shows that by taking only open-loop measurements, a complete design procedure for two-stage feedback amplifiers predicting closed-loop performance is available. Also, a thorough analysis of the circuit is given, including a discussion of such topics as DC stability with respect to beta, transient response, and gain-bandwidth product. It is shown that the amplifier has both AC and DC stability with respect to beta. It also shows that for best gain-bandwidth product, as little feedback as possible should be used. TAB

N67-10549# Gt. Brit. Ministry of Aviation, London.
CONTRIBUTION TO THE KNOWLEDGE OF SIGNAL AND NOISE EQUIVALENT CIRCUITS FOR U.H.F. TRANSISTORS [BEITRAEGE ZUR KENNTNIS DES SIGNAL-UND RAUSCHER SATZSCHALTBILDES VON UHF-TRANSISTOREN]
Werner Thommen Sep. 1966 49 p refs Transl. into ENGLISH from Diss. ETH Prom. (Switzerland), no. 3658, 1965 p 1–64
(TIL/T-5665) CFSTI: HC $2.00/MF $0.50

After summarizing the known noise properties of a generalized linear two-port, the author calculates the noise figure for uhf transistors by means of an equivalent circuit. It is established that

the usual equivalent circuits for the performance of hf transistors can be used up to frequencies of 2 kMc/s, provided they are expanded to incorporate the casing elements of the transistor. Author

N67-10598# Hewlett-Packard Co., Palo Alto, Calif.
TRANSISTOR PARAMETER MEASUREMENTS
[1966] 8 p refs *Its* Appl. Note 77-1

The technique for measuring "s" or scattering parameters is described, and some simple applications of s parameters to high frequency circuit design are illustrated. Advantages of s parameters are discussed, and consideration is given to frequency range of measurement, measurement accuracy, and typical values obtained. It is concluded that the use of s parameters shows great promise as a small signal analysis method because they are so convenient to apply to devices in transmission line applications. A.G.O.

N67-10738# Instituto de Energia Atomica, Sao Paulo (Brazil). Servico de Electrônica.
ELECTRONIC PULSE GENERATORS FOR ELECTROMECHANICAL DEVICES [PULSADOR ELECTRONICO PARA DISPOSITIVOS ELETROMECANICOS]
Ruy Borges da Silva Aug. 1965 13 p In PORTUGUESE; ENGLISH summary
(IEA-104)

An electronic low frequency pulse generator was developed for driving electromechanical units, with the precision and the stability necessary in most scientific and industrial applications. The repetition rate and the delay that determine state duration are adjustables. The circuit is semitransistorized, simple and economic, basically constituted of a monostable multivibrator triggered by a pulse generator, formed by an RC circuit and a cold cathode gas tube. Author (NSA)

N67-10932# Tung-Sol Electric, Inc., Bloomfield, N. J. Electron Tube Div.
ELECTRON TUBES RADIATION RESISTANT PILOT LINE PRODUCTION Final Progress Report, 21 May 1963–31 Mar. 1966
William A. Buchanan 10 Jun. 1966 137 p refs
(Contract DA-36-039-AMC-01476(E))
(AD-639610) CFSTI: HC $4.00/MF $1.00

During the contract period all work required for the delivery of engineering samples, tube types 5886, 6360, 6205, and 6080WB, was completed with the exception of the high temperature (500 C) life testing of tube types 6360, 6205 and 5886 in alumino-silicate glass. The primary objective of the contract - to establish the techniques and controls for producing tubes with alumino-silicate enclosures - has been achieved. As a result of the information gained from the radiation tests and high temperature life tests, it became apparent that further efforts to establish pilot run capabilities would not be feasible. (Author) TAB

N67-10956# Clevite Corp., Bedford, Ohio. Piezoelectric Div.
PRODUCTION ENGINEERING MEASURE FOR CERAMIC FILTERS Quarterly Report, 30 Mar.–29 Jun. 1966
A. Lungo 29 Jun. 1966 23 p
(Contract DA-36-039-AMC-01471(E))
(QR-13; AD-638913) CFSTI: HC $1.00/MF $0.50

Pressing, firing, and electroding of ceramic resonators for the preproduction filter samples and the production units was completed. Also, effort was directed toward the processing of resonators through the poling and frequency sorting operations. This effort has not been completed. Ladder filter subassemblies were fabricated and evaluated to determine tentative resonator specifications. This effort is described and discussed. Also discussed is a minor difficulty encountered in the assembly of these filters Author (TAB)

N67-10957# Sperry Microwave Electronics Co., Clearwater, Fla.
PRODUCTION ENGINEERING MEASURE FOR YIG SPHERES AND LIMITERS Final Report, 29 May 1963–21 Mar. 1966
R. L. Wickett, L. R. Hodges, Jr., and D. E. Tribby 21 Mar. 1966 132 p refs
(Contract DA-36-039-AMC-01477(E))
(SJ-222-0045-11; AD-638914) CFSTI: HC $4.00/MF $1.00

Single crystal formulae, with accompanying firing methods and procedures were developed and successfully tested during this program. A high degree of reliability in meeting predicted magnetization and linewidth values has been demonstrated. Single crystal, spherical resonators were formed and polished in production quantities; they demonstrated the desired electrical characteristics necessary for use in the power limiters. Microwave power limiters, making use of the spherical resonators, were designed and fabricated in the four required bands. These power limiters exhibited the required electrical and environmental characteristics as called out in General Specification SCL-5916A. Equipment and techniques necessary to form and polish YIG spheres was designed and fabricated during this program. This equipment was thoroughly tested and found to meet the program requirements. The limiter production run was performed, and 40 units were successfully assembled and tested using the design, assemble and test techniques developed for use on this program. The sphere production run produced 70 pure YIG and 70 GaYIG spheres of good quality, in the required diameters. The limiter and sphere production runs successfully demonstrated the capability of meeting the production requirements as outlined at the start of the program Author (TAB)

N67-10988# Air Force Cambridge Research Labs., Bedford, Mass.
A MICROWAVE CORRELATION RADIOMETER
William B. Goggins, Jr. Aug. 1966 32 p refs *Its* Instrumentation Papers-108
(AFCRL-66-534; AD-639328) CFSTI: HC $2.00/MF $0.50

A practical microwave correlation radiometer was built and tested. Feedback was used to ensure stability and make it unnecessary to match receiver channels. The rms temperature deviation was derived and found to be square root of 2 times that of a total power radiometer. Two separate systems to provide an ac multiplier output were built and evaluated. In one, the receiver channels were tuned to a slightly different frequency while in the other, phase reversal in one channel at an ac rate provided the modulation. The latter method proved easier to instrument Author (TAB)

N67-10996# CTS Corp., Elkhart, Ind. Research and Development Div.
PRODUCTION ENGINEERING MEASURE FOR SUBMINIATURE, TRANSISTOR TYPE POTENTIOMETERS Quarterly Progress Report, 1 Apr.–30 Jun. 1966
C. L. Holmes and D. C. Kinsey 30 Jun. 1966 12 p
(Contract DA-36-039-SC-85976(E))
(QPR-20; AD-638970) CFSTI: HC $1.00/MF $0.50

The fabrication and testing of preproduction samples was completed, and authorization was granted to initiate the pilot run. Additionally the quality assurance functions relative to preliminary inspection of pilot run quantities have begun. H.S.W.

N67-11016# Radio Corp. of America, Somerville, N. J.
THIN-FILM POLYCRYSTALLINE FIELD-EFFECT TRIODE Seventh Quarterly Report, 1 Jan.–31 Mar. 1966
M. L. Topfer, J. J. Bowe, J. J. Fabula, W. H. Laznovsky, R. L. Schelhorn et al Ft. Monmouth, N. J., Army Electron. Command, Sep. 1966 44 p refs *Its* Rept.-7
(Contract DA-28-043-AMC-00231(E))
(ECOM-00231-7; AD-639433) CFSTI: HC $2.00/MF $0.50

Post-fabrication thermal processing was studied during this quarter. Thermal processing of a small number of experimental units showed that greatly improved gate insulator stability could be

achieved. Problems of device yield and the dependence of achievable stability on the fabrication parameter of the device were recognized. A program was initiated to fabricate a large number of samples for testing purposes. A new TFT fabrication facility was put into operation to augment the present facility. Devices were fabricated and tested for the beginning of a life testing program of thermally processed units. Stability investigation on experimental TFTs were continued. Standard device stability testing of drain current variations with time was continued on recently fabricated units. Additional testing pertinent to device stability was initiated. These included gate capacitance measurements and gate impedance measurements. These tests were accomplished on unprocessed units. The work on photoemission into thin-film insulators has been used to study the energy band diagram of metal-insulator and semiconductor-insulator contacts. We have studied A12O3, SiO, SiO2, and CaF2 in contact with Al, Au, and CdSe electrodes. The work on SiO and SiO2 is a continuation of last quarter's work and the results have been consistent with what has been previously reported Author (TAB)

N67-11024# Army Electronics Labs., Fort Monmouth, N. J.
RESISTANCE-CAPACITANCE ACTIVE FILTERS
Eugene J. Chabak Aug. 1966 24 p refs
(ECOM-2744; AD-639240) CFSTI: HC $1.00/MF $0.50

Techniques are presented whereby various filter transfer functions are synthesized utilizing resistors, capacitors and transistors. Low-pass, high-pass and band-pass amplitude characteristics can be attained. Furthermore, complete filtering circuits are presented along with their respective amplitude characteristic and simplified design equations Author (TAB)

N67-11052# Cornell-Dubilier Electronics Div., Federal Pacific Electric Co., Norwood, Mass.
PRODUCTION ENGINEERING MEASURE FOR PRODUCTION OF SILICON MONOXIDE CAPACITORS *Final Report, 29 May 1963–29 Jul. 1966*
Welville B. Nowak Jul. 1966 177 p refs
(Contract DA-36-039-AMC-01478(E))
(AD-639588) CFSTI: HC $5.00/MF $1.00

A pilot production process for fabricating SiO microelement capacitors at a rate of 2,000 per eight-hour shift was demonstrated and the products therefrom tested and shown to pass the required specifications. Each microelement (0.310 in. square) contains 1, 2, 3, or 4 capacitors with values of 1120 and 560, 180, 100, and 68 pf per capacitor, respectively. In addition to the general requirements of microelements and micromodules, some of the more important specifications are: dissipation factor (DF) or = 1.5%, dielectric withstanding voltage = 150 volts, insulation resistance (IR) > 1000 megohms at 50 volts and 25 C and > 75 megohms at 125 C, Delta C/C + or = 15% (−55 to +125 C), and a long term life test of 2000 hours at 125 C and 100 volts after which DF or = 3% and IR (25 C) > 200 megohms for 560 pf and > 750 megohms for 180, 100 and 68 pf units and IR (125 C) > 20 megohms for 500 pf and > 50 megohms for other capacitance values. The capacitors are vacuum deposited in a multi-station jig using as heated evaporation sources. The alumina ceramic substrates were metalized with Au-Pt at the peripheral terminations and the interior area was glazed, using a fritted-glass tape. The aluminum electrodes are about 5000 A thick and the SiO dielectric is about 16,000 A thick. Deposition rates are about 50 A/sec. Rates and film thicknesses are monitored and controlled. Vacuum chamber pressure is 1 to 4 x 10 to the minus 5th power torr. Substrate temperature is 170 C during depositions. Yields of about 90% were achieved Author (TAB)

N67-11081# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SENSITIVE STABLE AMPLITUDE DISCRIMINATOR
V. A. Federov and G. G. Doroshenko 6 Jun. 1966 9 p ref Transl. into ENGLISH from Vopr. Dozimetr. Zashchit. ot Izuch. (Moscow), v. 3, 1964 p 77–81
(FTD-TT-65-1819; TT-66-62224; AD-638871) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: sensitive stable amplitude discriminator. Author (TAB)

N67-11148# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR MEASURING TEMPERATURE
B. A. Pashkovskiy and M. B. Fridzon 28 Jun. 1966 5 p Transl. into ENGLISH from Russian Patent no. 168499 (Appl. no. 796794/26-10, 1 Oct. 1962) 2 p
(FTD-TT-65-1938; AD-638880) CFSTI: HC $1.00/MF $0.50

The object of the invention is a device for measuring temperature which contains a generator of high-frequency oscillations and an oscillating circuit consisting of an induction coil and a capacitor and used as a pickup of temperature. For the purpose of automation and continuity of measurements the oscillating circuit is introduced into the feedback circuit of the generator. TAB

N67-11157# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PARAMETRIC BAND-PASS FILTER
V. A. Taft and E. I. Galynker 25 Apr. 1966 6 p Transl. into ENGLISH from Russian Patent no. 168529 (Appl. no. 905120/26-24, 4 Jun. 1964) 2 p
(FTD-TT-65-2027; AD-639377) CFSTI: HC $1.00/MF $0.50

The object of the invention is parametric pass-band-filter based on parametrons. To obtain a narrow u-shaped regulable amplitude-frequency characteristic, the source of the filterable signal is connected to the circuits of pumping of two parametrons with amplitude-frequency characteristics shifted onto the pass-band, the output of the first parameter is connected through an inverter to the first parameter is connected through an inverter to the first input of the matching circuit. The output of the second parametron, the amplitude-frequency characteristic of which is shifted into the region of the lower frequencies, is connected to the second input of the matching circuit (coincidence circuit). Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N67-10060# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
THE AUTOMATIC CONTROL SYSTEM FOR SAMPLES TRANSPORT (SELF-SERVICE "MAIL") [UKLAD AUTOMATYCZNEGO STEROWANIA TRANSPORTEM PROBEK (SAMOCZYNNA "POCZTA")]
J. Lenartowicz and A. Turos Feb. 1966 25 p ref In POLISH; ENGLISH summary
(INR-696/I/PL) CFSTI: HC $1.00/MF $0.50

A device for an automatic transport of small samples between two terminal positions is described. At one of those positions samples can be activated and the activities are counted at the other position according to the prescribed routine. The system allows for: (1) programming of irradiation and counting time at each of the two extreme positions; (2) automatic removal of samples from the stack; (3) throwing them away as the measurement cycle is over, and so on. The main reason for construction of the system was to use it in connection with a 100-channel analyzer for the investigations of nuclear reaction products with decay periods of 0.5–10 sec. Practical sample transport time amounts to about 1 sec/4 m. Author

N67-10314# System Development Corp., Santa Monica, Calif.
PUSHDOWN AUTOMATA WITH BOUNDED BACKTRACK
Jeffrey Ullman 3 Dec. 1965 36 p refs
(Contract AF 19(628)-5166)
(TM-738/022/00; AFCRL-66-550; SR-7; AD-638194) CFSTI: HC $2.00/MF $0.50

The report considers two classes of pushdown automata (pda), and the languages accepted by them. These pda accept their languages rapidly because they reread the input word a limited number of times, hence, such languages are particularly useful as programming languages. The first class, strong bounded backtrack pda, read input words from left to right, and jump from right to left (backtrack). The languages accepted by such automata will be shown to be equivalent to the finite unions of deterministic languages. The second class, weak bounded backtrack an arbitrary number of times. The device reads a word from left to right, simulating the action of the pda. Every time the pda reaches a total configuration (state and pushdown tape) in which it is possible to read another input letter, that configuration is stored. If no move at all is possible in a given configuration, it is erased from storage. Thus one can accept the language with no backtrack without having to keep track of an arbitrary number of possible configurations of the pda. Several results will be shown about each of these classes of pda, including operations that preserve the properties. While these properties are not preserved by all gsm mappings, it will be shown that information lossless gsms preserve the weak bounded backtrack property, and information lossless gsms of finite order preserve the strong bounded backtrack property
Author (TAB)

N67-10389# Joint Publications Research Service, Washington, D. C.
AUTONOMY IN MULTIPLY-CONNECTED VARIABLE-STRUCTURE AUTOMATIC CONTROL SYSTEMS
B. N. Petrov, S. V. Yemel'yanov, and M. B. Gritsenko 17 Oct. 1966 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSR (Moscow), v. 169, no. 1, Jul.–Aug. 1966 p 52–54
(JPRS-38175; TT-66-34602) CFSTI: $1.00

Some problems in the synthesis of control of multiply-connected objects, whose internal properties determine the presence of finite or differential relationships with respect to the controlled coordinates, are investigated. The parameters of the controlled objects are assumed to vary within sufficiently broad limits. A proposal is made that the problem of autonomy be solved by using variable structure systems, i.e., systems in which the structure and parameters of the regulator vary in a discontinuous fashion during the transient process in accord with a selected logical law and depending on the state of the system. Using the properties of variable structure systems, a multiply-connected control system is constructed which is atuonomous in some subspace of the phase of its coordinates in such a way that the conditions of autonomy have low sensitivity to variation within sufficiently broad limits of the controlled object's characteristics. R.N.A.

N67-10397# Joint Publications Research Service, Washington, D. C.
MILITARY APPLICATIONS OF CYBERNETICS
Heinz Raulien 26 Jul. 1963 167 p refs Transl. into ENGLISH from German
(JPRS-20343; OTS-63-31377) CFSTI: $3.00

Presented is a discussion of: the role of technology in the development of military technology; basic principles of cybernetics in technology; the applicability of control and regulation techniques in military technology; the principles of computer techniques and the applicability of automatic computers in military technology; and the use of cybernetic machines in troop command and military planing. S.C.W.

N67-10485# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL CONTROL IN ORDINARY DYNAMIC SYSTEMS
N. N. Krasovskiy 21 Mar. 1966 39 p refs Transl. into ENGLISH from Usp. Mat. Nauk (Moscow), v. 20, no. 3, 1965 p 153–174
(FTD-TT-65-2014; TT-66-62090; AD-637390) CFSTI: HC $2.00/MF $0.50

Translation of Russian research: optimal control in ordinary dynamic systems. Author (TAB)

N67-10491# Northwestern Univ., Evanston, Ill. Information-Processing and Control Systems Lab.
ORTHOGONAL PROJECTION AND DISCRETE OPTIMAL LINEAR SMOOTHING
James S. Meditch Jul. 1966 31 p refs
(Contract N00014-66-C0020-A03)
(TR-66-102; AD-638684) CFSTI: HC $2.00/MF $0.50

The smoothing filter and smoothing error convariance matrix equations are developed for discrete linear systems using the method of orthogonal projection. Two equivalent formulations are presented and found to agree with those of previous authors who had used other methods. The present results in conjunction with the earlier work of Kalman on prediction and filtering give a complete treatment of the discrete linear estimation problem from the viewpoint of orthogonal projection Author (TAB)

N67-10660# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
AUTOMATIC SYSTEMS APPLIED TO NEUTRON SPECTROMETRY
S. Bevilacqua, E. de Agostino, and B. Rispoli 1966 7 p refs
(RT/EL(66)2)

An analysis of different solutions adopted for automatic control systems of neutron spectrometry is presented. The criteria from which control systems were designed is discussed. NSA

N67-11058# Rydbeck Research Associates AB, Fjaeras (Sweden).
INSTABILITY PROPERTIES OF AN IONIZED MEDIUM PERIODIC IN TIME AND SPACE. TRANSIENT WAVE PROPAGATION IN SYMMETRIC IONIZED EPSTEIN LAYERS
J. Askne and B. O. Roennaeng 10 Jun. 1966 23 p refs
(Contract AF 61(052)-864)
(SR-5; AFCRL-66-609; AD-637940) CFSTI: HC $1.00/MF $0.50

Different kinds of instability in a medium with a density varying due to a progressive pumpwave are studied and it is found that the dispersive ionized medium yields possibilities for traveling wave parametric amplification. (Askne) Transient wave response of a symmetric ionized Epstein layer is examined. The envelopes of the transmitted and reflected electric fields at different carrier frequencies are depicted and compared with approximate results. TAB

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N67-10006# Sheffield Univ. (England). Dept. of Fuel Technology and Chemical Engineering.

THE DESIGN AND CONSTRUCTION OF A SHOCK TUNNEL TEST SECTION FOR VELOCITY MEASUREMENT STUDIES

R. J. Parsons *In its* Intentional Combust. Oscillations in Propulsion Systems 25 Apr. 1966 35 p refs (See N67-10006 01-33) CFSTI: HC $3.00/MF $0.75

In the operation of shock tunnels few methods are available for the measurement of gasdynamic properties in the test section. A technique based on electromagnetic induction shows promise for the measurement of velocity. A rectangular test section has been designed and built for use in such velocity measurement experiments. The section has flexible walls to enable supersonic combustion experiments to be carried out. Optical observation of the gas-flow is also possible and a high speed camera is to be used to take Schlieren photographs of the flow. An indication of measurements to be taken is also given. Author

N67-10174*# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

MANUAL CONTROL DATA ACQUISITION FACILITY

M. J. Merritt and S. H. Shaar *In its* Res. on New Tech. for the Analysis of Manual Control Systems 15 Jun. 1966 p 2-3 (See N67-10173 01-05) CFSTI: HC $1.00/MF $0.50

Development of an experimental station for studies of multiple input manual tracking control tasks continued. A manual control stick was designed and mounted on the newly installed pilot's seat. Cables were fabricated to connect the analog computer patchboard to the display devices, control sticks, eye position transducer, FM tapy recorder, and communication system. The following digital computer programs were written to support the facility: 7X sample, 7X dump, scale factor, signal distribution function, and the system routines of D load and D dump. R.Li.

N67-10311# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

PERFORMANCE STUDY OF THE DEWLINE ICE CAP STATIONS GREENLAND, 1963

S. C. Reed May 1966 30 p refs
(CRREL-SR-72; AD-638136) CFSTI: HC $2.00/MF $0.50

To study the performance of the DEWline ice cap stations, the following semiannual observations are made: footing elevation and settlement, horizontal angle measurements to indicate lateral movement of the structure, measurement of vertical movement in the sewage disposal and fuel storage systems, and measurement of snow temperature, accumulation, and density. The 1963 observations indicate that in general the structures and utilities are performing as predicted Author (TAB)

N67-10344# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.

TESTING OF MASKED LAMPS IN TAXIWAY EDGE LIGHTS Final Report

Cecil B. Phillips Jul. 1966 17 p refs
(RD-66-44; AD-638492) CFSTI: HC $1.00/MF $0.50

Technical tests were performed to investigate the use of masked lamps in taxiway edge lights. These lamps were tested to determine if there were advantages in their use over the ones now being used. The masked lamps were superior for use on the straight portions of the taxiway and on curves where at least three lamps were visible. They were also superior in that they reduced off-taxiway light to a minimum Author (TAB)

N67-10349# Naval Ammunition Depot, Crane, Ind.

EXPERIMENTAL HIGH INTENSITY FLARE SYSTEMS: DESIGN AND TESTS OF

John E. Wildridge Aug. 1966 119 p refs
(RDTR-75; AD-638490) CFSTI: HC $4.00/MF $0.75

Flight and static test results are presented of various configured parachute suspended flare systems. It was shown that a five-million candlepower, five-minute burning time flare can be achieved by utilizing multiple flares in the vertical or the horizontal attitude. It is also shown that multiple parachutes can be utilized to obtain a low rate of descent although there appears to be a loss in efficiency as the number of parachutes is increased. Actual photometric data taken during flight tests is presented for various configured illuminating flare systems Author (TAB)

N67-10381# Cerro Tololo Inter-American Observatory, La Serena (Chile).

[OBSERVATORY ACTIVITIES] Bimonthly Report, Jul.-Aug. 1966 Aug. 1966 24 p refs Prepared jointly with Kitt Peak Natl. Obs. Sponsored by NSF

Progress on the engineering development, electronics, construction, and improvement of the Cerro Tololo Inter-American Observatory, La Serena, Chile is reported. Activities at the Kitt Peak National Observatory, Tuscon, Arizona are also included. Observations with Kitt Peak's 84-inch, 36-inch, and 16-inch telescopes; the development of Ritchey-Chretien correctors for the 84-inch and 36-inch telescopes; the use of computer programs to control observing programs; work on the 82-inch) quartz heliostat flat; and a spectroscopic study of water vapor on Venus are discussed. R.N.A.

N67-10424# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.

A CONFIGURATION DESIGN CONCEPT FOR DISTANCE CODED MARKING OF CATEGORY II AND IIIA RUNWAYS Final Report

Robert K. Mc Kelvey and Guy S. Brown May 1966 138 p refs
(RD-66-37)

Eight experiments were conducted to provide a configurational design concept for a system of distance coded runway marking geared particularly to the support of landing and take-off operations bright daylight contact fogs (fog extending to the surface—no ceiling). Among other criteria the system must meet are distance coding of a bidirectional runway, compatibility with runway lighting, and resistance to loss of configurational integrity through operational wear. A symbolic distance indicating system was regarded as having demonstrated the greatest potential for meeting the full array of design objectives and is recommended for service test and evaluation. Author

N67-10626# Stanford Univ., Calif. Stanford Linear Accelerator Center.

MAGNETIC FIELD EFFECTS IN HYDROGEN THYRATRONS

Robert W. Bradford May 1966 13 p Presented at the 9th Modulator Symp., Fort Monmouth, N. J., 11-12 May 1966
(Contract AT(04-3)-400)
(SLAC-193; CONF-660528-4) CFSTI: HC $1.00/MF $0.50

The use of weak magnetic fields to improve the performance of hydrogen thyratrons (higher peak and avarage power levels, tighter anode delay-time stability, higher anode hold-off voltages, and faster repetition rates) is discussed. NSA

N67-10632# Texas A&M Univ., College Station.

THE TEXAS A AND M VARIABLE ENERGY: PROGRESS AND STATUS, JANUARY 1966

W. A. Mc Farlin, J. A. Mc Intyre, M. A. Nowak, M. N. June, and L. B. Hardeman [1966] 4 p Presented at the Meeting of the Soc. of Appl. Spectry., Chicago
(Contract AT(40-1)-3398)
(ORO-3398-4; CONF-660611-2) CFSTI: HC $1.00/MF $0.50

A progress and status report on the Texas A & M Variable Energy Cyclotron is presented which includes its general objectives, description, modifications, budget, schedules, building description, and active and planned research programs. NSA

N67-10642# California Univ., Berkeley. Lawrence Radiation Lab.
BEAM DIAGNOSTICS AND INSTRUMENTATION
D. J. Clark May 1966 34 p refs Presented at the Intern. Conf. on Isochronous Cyclotrons, Gatlinburg, Tenn., 1–5 May 1966
(Contract W-7405-ENG-48)
(UCRL-16792; CONF-660510-17) CFSTI: HC $2.00/MF $0.50

Methods of cyclotron beam development and diagnostics are described. Techniques for measuring the space, time, and energy distributions of both internal and external beams are included. Emphasis is on the more recent methods commonly used at many laboratories. Author (NSA)

N67-10645# California Univ., Davis. Crocker Nuclear Lab.
CENTRAL REGION STUDIES FOR INCORPORATING AN AXIAL ION SOURCE IN THE DAVIS 76" CYCLOTRON
J. A. Jungerman, L. J. Kibbe, and N. F. Peek 20 May 1966 11 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn.
(Contract AT(11-1)-GEN-10)
(UDC-CNL-49; CONF-660906-1) CFSTI: HC $1.00/MF $0.50

Magnetic field measurements are presented for the cyclotron. The effects of an axial ion source on these measurements are discussed. NSA

N67-10649# Brookhaven National Lab., Upton, N. Y.
SIMULATION TECHNIQUES APPLIED TO THE DESIGN OF THE 80-INCH LIQUID HYDROGEN BUBBLE CHAMBER EXPANSION SYSTEM
C. L. Goodzeit Jun. 1966 21 p refs Presented at the 1966 Sci. Computing Symp., Yorktown Heights, N. Y., 20–22 Jun. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10326; CONF-660631-1) CFSTI: HC $1.00/MF $0.50

During the design phase of BNL's 80-inch Liquid Hydrogen Bubble Chamber Project, a study was made of a non-linear dynamic system that was programmed for operation on a digital computer. The theoretical technique for analyzing the expansion system of the bubble chamber is outlined. NSA

N67-10657# National Inst. for Research in Nuclear Science, Harwell (England). Rutherford High Energy Lab.
MAGNETO-OPTICAL DEVICE FOR LINAC QUADRUPOLE ALIGNMENT
D. J. Warner and J. S. Webb [1965] 8 p refs *Its* Accelerator Phys. 21
(NP-16169)

The description and operation of a magneto-optic device for alignment of quadrupole magnets in linear accelerators are presented. NSA

N67-10768# California Univ., Los Angeles.
SYNCHROCYCLOTRON CONVERSION
K. R. Mac Kenzie [1966] 20 p refs Presented at the Intern. Conf. on Isochronous Cyclotrons, Gatlinburg, Tenn., 2–5 May 1966
(Contract AT(04-1)-GEN-12)
(CONF-660510-19) CFSTI: HC $1.00/MF $0.50

The possibility of increasing the output of f-m cyclotrons is being explored simultaneously in many laboratories. Space charge seems to be the limiting factor. Practically every laboratory is investigating a form of hooded source known as the Livingston, calutron or Oak Ridge source. The ions must clear such a source so higher dee voltages are needed. The higher dee voltage is desirable in any case since the beam usually increases as some power of this voltage (if the repetition rate is increased correspondingly). The theoretical picture indicates a variation between V and V^2. Some f-m cyclotrons will try to increase performance by this method alone. Others will include all the possible improvements including a complete sector field near isochronism which will provide strong vertical focusing and reduce the frequency swing. The largest machines will probably try to achieve their goal by small sectors near the source and somewhat larger limited radii sectors on the poles (with an unchanged radial profile). The status of these efforts is reviewed and some data on the Berkeley model program is given. It appears that most f-m cyclotrons will eventually be partially or wholly converted to sector focused synchrocyclotrons. Author (NSA)

N67-11078# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OXYGEN GASIFIER FOR PROLONGED MAINTENANCE OF LIQUID OXYGEN UNDER PRESSURE
G. I. Voronin and M. V. Zolotukhin 18 Apr. 1966 5 p Transl. into ENGLISH from Russian Patent no. 168735 (Appl. no. 837399/23-26, 18 May 1963) 2 p
(FTD-TT-65-1740; AD-638882) CFSTI: HC $1.00/MF $0.50

The object of the invention is an oxygen gasifier for prolonged maintenance of the liquid oxygen under pressure, consisting of a thick-walled vessel with heat insulation, a system of gasification, and regulation of the pressure, to prevent over-heating the liquid oxygen at the walls of the vessel and its premature evaporation. The vessel has arranged inside of the inner cavity heat bridges with little thermal resistance. TAB

N67-11093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE METHOD OF TESTING METALS AT HIGH TEMPERATURE AND PRESSURE VALUES
M. L. Gorb 13 Jun. 1966 12 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 10, no. 5, 1964 p 547–551
(FTD-TT-65-1887; TT-66-62286; AD-639160) CFSTI: HC $1.00/MF $0.50

The construction is described of a new variant of conical cylindrical high pressure chamber. A method is proposed for measuring temperatures in the high pressure chamber, based on the principle of a natural thermocouple Author (TAB)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N67-10052# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF CORRECTIVES FOR READINGS OF TOTAL HEAD NOZZLES IN SUPERSONIC FLOW OF RAREFIED GAS
V. A. Sukhnev *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 105–113 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

The value of the corrective is determined, and the experimental results for the corrective at Mach number 3.6 to 6, and at Reynolds number 10 to 40 are reported. The geometrically congruent total head nozzles used were: spherical, with a ratio of the inlet orifice diameter to the external nozzle diameter $(d/D) = 0.1$; and cylindrical, with flat face and ratios $d/D = 0.1$ and 0.75. The

determination of the corrective to the readings of total head nozzles due to rarefaction of the free flow is considered. Experimental data are illustrated, and the data are compared and discussed. N.E.N.

N67-10053# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DEVELOPMENT OF WAVES ON THE SURFACE OF FILMS OF VARIABLE VISCOSITY UNDER A GAS FLOW

E. V. Semenov *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Aug. 1966 p 114–118 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

The behavior of disturbed waves on the surface of thin films of heavy viscous liquids with a constant, high temperature gradient under hot gas flow is considered. It is assumed that the viscous gas is involved in motion by an infinite plate moving at constant velocity. The method of calculation, based on the Navier–Stokes and Orr–Sommerfeld equations, is outlined, and the results are indicated. N.E.N.

N67-10073# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE NONSTATIONARY MOTION OF A VISCOUS FLUID IN A THIN ELASTIC CYLINDRICAL TUBE

N. A. Kil'Chevskii, G. L. Komissarova, and V. S. Martynenko [1965] 5 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 11, 1965 p 1438–1442 CFSTI: HC $1.00/MF $0.50

The motion of a viscous compressible fluid in a deformed elastic cylindrical tube is investigated for a given law of endplate-section motion, defined by the generalized coordinates $x_1(t)$ and $x_2(t)$ where t is time. Considered were tubes for which the critical Reynolds numbers are large and the ratio of tube thickness to diameter is small. A system of integral equations is derived, and an elementary method of solving the Laplace transform is demonstrated. K.W.

N67-10075# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.

THE MEASUREMENT OF RADIAL VOIDAGE DISTRIBUTION IN TWO-PHASE FLOW BY ISOKINETIC SAMPLING

G. L. Shires and P. J. Riley 1966 47 p refs

(AEEW-M-650) HMSO: 7s

There is a need for an instrument which will measure the detailed distribution of the phases and their local velocities. This report describes a probe through which a two-phase sample is withdrawn at such a rate that the pressure just inside the probe orifice is equal to the local static pressure in the stream. Theoretically, when the density of the gas is small relative to that of the liquid, the superficial velocity of the liquid on entering the probe is equal to the local value in the stream, i.e. the probe samples isokinetically in terms of superficial water velocity, and the voidage of the sample is equal to the local voidage in the stream. Both characteristics have been confirmed experimentally in air/water flowing upwards in a 1 inch diameter tube at atmospheric pressure over a range of mean voidage from 0.1 to 0.8. Although theoretically it is possible to determine voidage from impact pressure this alternative method was found to be unsatisfactory because of accumulation of errors and probe interference. Author

N67-10094# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.

ON THE INCOMPRESSIBLE LAMINAR BOUNDARY LAYER FOR IMPULSIVE MOTION OF A SEMI-INFINITE FLAT PLATE

Teruaki Akamatsu and Goro Kamimoto Jun. 1966 18 p refs

(CP-10) CFSTI: HC $1.00/MF $0.50

The incompressible boundary layer on a semi-infinite flat plate which starts to move impulsively was solved by adopting Meksyn's method for the steady boundary layer with pressure gradient. The approximate solution which varies smoothly from Rayleigh's unsteady solution to Blasius's steady solution was obtained and also ascertained to agree considerably well with the resonable numerical solution by Lam and Crocco. Author

N67-10136# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.

VISCOUS FLOW IN A RECTANGULAR CUT-OUT AND STATIC-HOLE ERRORS

Zeev Rotem Jun. 1965 43 p refs

(Grant NRC A-2772)

CFSTI: HC $2.00/MF $0.50

Analytical and numerical solutions for viscous flow in a rectangular cut-out (a two-dimensional static hole) are given for several boundary conditions at the free side. These solutions are shown to yield detailed information on the flow configuration in the cut-out, which cannot be predicted from known approximate treatments. In a separate investigation, all known data concerning static hole errors for the single geometry of the sharp edged square hole are reviewed. A uniform method of representation is proposed and empirical correlations summarizing these data are obtained. R.N.A.

N67-10191*# National Aeronautics and Space Administration, Washington, D. C.

RECENT RESEARCH ON THE PROBLEM OF BASE PRESSURE [RECHERCHES RECENTES SUR LE PROBLEME DE LA PRESSION DE CULOT]

P. Carriere May 1964 22 p refs Transl. into ENGLISH of the paper presented at the Conf. on Fluid Mech., Paris, 18 Feb. 1963 (NASA-TT-F-8873) CFSTI: HC $1.00/MF $0.50 CSCL 20D

A method to predict the flow behavior at the base of a supersonic body, such as the supersonic transport plane Concord, is presented, and some basic problems connected with this theory are reveiwed. Mathematical expressions are given for the flow conditions in the mixture zone, the isobaric turbulent mixture, the relation between the temperature profile and the velocity profile, and the behavior of the boundary layer during the expansion at B. R.U.

N67-10259# Navy Underwater Sound Lab., New London, Conn.

EFFECTS OF PRESSURE GRADIENTS ON TURBULENT BOUNDARY-LAYER WALL-PRESSURE FLUCTUATIONS

Howard H. Schloemer (Ph.D. Thesis–Stevens Inst. of Tech.) 1 Jul. 1966 89 p refs

(Rept.-747; AD-638133) CFSTI: HC $3.00/MF $0.75

The low-turbulence subsonic wind tunnel was significantly modified so that turbulent boundary-layer pressure fluctuation measurements could be made with adequate signal-to-noise ratio over a wide frequency range. Measurements were made in a mild adverse and a mild favorable pressure gradient with natural transition occurring in the boundary layer. To make certain that the facility was operating correctly and to establish a basis for comparison, the zero-pressure gradient case was investigated. For this case, the spectral density, magnitude of the normalized longitudinal and lateral cross-spectral density functions, and convection velocity as a function of longitudinal separation and frequency were in excellent agreement with other experimenters. When comparison is made to the zero-pressure gradient in the same non-dimensionalized frequency band and at similar non-dimensionalized longitudinal spacings, the convection velocity ratio is higher in the favorable and lower in the adverse pressure gradients, primarily due to the change in shape of the mean velocity profile. The effect of an adverse pressure gradient on the non-dimensionalized spectral density is to increase the low-frequency content without influencing the high-frequency portion appreciably, when compared to the zero-pressure gradient case Author (TAB)

N67-10354# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

THE STRUCTURE OF A SHOCK WAVE WITH ACCOUNT TAKEN OF THE TRANSFER OF MOMENTUM AND ENERGY BY RADIATION

V. S. Imshennik and Yu. I. Morozov 12 Jul. 1966 34 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, 1965 p 8–21
(Contract NOw-62-0604-c)
(TG-230-T489; TT-66-62148; AD-637997) CFSTI: HC $2.00/MF $0.50

The following simplifying assumptions are made in the equations of relativistic gas dynamics with radiative energy transfer: negligible pressure ahead of the shock, constant absorption coefficient, and ideal gas with an effective adiabatic exponent. The angular distribution of radiation intensity is averaged using Eddington's method or a diffusion approximation. The two methods of averaging lead to the same approximate expressions, differing only slightly in the values of numerical coefficients. For a general case, familiar ordinary nonlinear differential equations, to be solved numerically, are derived. The integral curve satisfying the boundary conditions passes through two singular points. Although only first-order relativistic effects are considered, the radiative transfer is shown to have a pronounced effect on the shock structure, depending on the flow density and velocity.
Author (TAB)

N67-10366# Naval Oceanographic Office, Washington, D. C.

DERIVATION OF A GENERAL FUNCTION OF WAVE HEIGHT DISTRIBUTION OVER THE SURFACE OF A HEAVY LIQUID [VYVOD OBOBSHCHENNOY FUNCTSII RASPREDELENIYA VYSOT VOLN NA POVERKANOSTI TYAZHELOY ZHIDKOSTI]

I. S. Brovikov 1966 15 p refs Transl. into ENGLISH from Tr. Gos. Okeanograf. Inst. (Moscow), v. 42, 1958 p 105–114
(TRANS-249; AD-638601) CFSTI: HC $1.00/MF $0.50

The statistical characteristics of wave height period in a deep sea are analysed on the basis of instrumental records and compared with the characteristics based on theoretical considerations. Thus the sinusoidal wave form is corrected and the appropriate formulae for characterizing the complex distribution functions of wind wave elements are derived Author (TAB)

N67-10378# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.

ON THE THEORY OF TRANSPORT COEFFICIENTS FOR MODERATELY DENSE GASES

Larry K. Haines (Ph.D. Thesis) Jun. 1966 226 p refs
(Grants DA-ARO(D)-31-124-G676; DA-ARO(D)-31-124-G783)
(BN-460; AROD-5960-1; AD-637798) CFSTI: HC $6.00/MF $1.25

A complete description of the method of Cohen-Dorfman-Ernst (in time or t language) and the method of Zwanzig (in Laplace transform or epsilon language) for computing a density expansion of the diffusion coefficient in a moderately dense gas, with short-range, repulsive molecular interactions, from time-correlation functions is given. Both of these methods are reformulated in order to facilitate their comparison. The methods are found to give identical results for the density expansion of the diffusion coefficient insofar as this expansion exists. It is shown, however, that the methods are not identical for arbitrary t and epsilon; that is, the Zwanzig method is not simply the Laplace transform of the Cohen-Dorfman-Ernst method. A derivation of the Zwanzig method is given, and the differences in motivation of the two methods are discussed Author (TAB)

N67-10416*# Princeton Univ., N. J. Plasma Physics Lab.

PROPAGATION OF CORRELATIONS IN A BOLTZMANN GAS Scientific Report

Edward A. Frieman and Robert Goldman May 1966 66 p refs
(Grant NSG-220-62; Contract AF 49(638)-1555)
(NASA-CR-79828; PPL-AF-2; AD-636528) CFSTI: HC $3.00/MF $0.75 CSCL 20D

New results are obtained on the propagation of correlations in a Boltzmann gas on the scale of the mean free path and the collisional time scale which appear to support a conjecture of M. Green's on this subject. Author (TAB)

N67-10429# Boeing Scientific Research Labs., Seattle, Wash. Flight Sciences Lab.

HYDRODYNAMIC STABILITY OF VISCOUS FLOWS

F. D. Hains Apr. 1966 121 p refs *Its* Rept.-105
(D1-82-0527)

The Orr-Sommerfeld equation, which governs the stability of parallel flows, was solved by a numerical technique. Neutral stability curves were obtained for three different problems. The first problem is concerned with the effect of a flexible wall on the stability of the boundary layer on a flat plate. The effect of variation of each wall property on the various modes was found, but further numerical calculations are required before a wall can be found which can clamp out all the modes of instability. The second problem is concerned with the stability of magnetohydrodynamic channel flow with an aligned magnetic field. The general stability equations for small values of the magnetic Reynolds number were solved. The last problem deals with the stability of Couette-Poiseuille flow. The velocity profile was continuously varied from the parabolic to the linear by moving the upper wall and reducing the pressure gradient, simultaneously. The numerical results show that Poiseuille flow has the lowest critical Reynolds number of all the profiles considered, and that complete stability is obtained before the linear profile of Couette flow is reached. Author

N67-10529# Los Alamos Scientific Lab., N. Mex.

THE PARTICLE-IN-CELL METHOD FOR THE CALCULATION OF THE DYNAMICS OF COMPRESSIBLE FLUIDS

Anthony A. Amsden 24 Jun. 1966 170 p refs
(Contract W-7405-ENG-36)
(LA-3466) CFSTI: HC $5.00/MF $1.00

An extensive discussion of the Particle-in-Cell computing method for solving nonsteady two-dimensional fluid dynamics problems is presented. The topics treated include boundary conditions, numerous properties of the method, its applicability and limitations, and the inclusion of additional physical effects, such as the full viscous stress tensor which is discussed for the first time. Flow diagrams for a PIC code and examples of several calculational results are also presented. Author (NSA)

N67-10540# Los Alamos Scientific Lab., N. Mex.

A STUDY OF SOME OF THE PARAMETERS AFFECTING KNUDSEN EFFUSION. DEVIATIONS FROM THE COSINE LAW AS A FUNCTION OF CELL GEOMETRY, CELL MATERIALS, AND NATURE OF THE EFFUSING SPECIES

John W. Ward 2 Aug. 1966 144 p refs
(Contract W-7405-ENG-36)
(LA-3509) CFSTI: HC $4.00/MF $1.00

Experimental studies of the distributions of particles effusing from a Knudsen cell at high temperatures (1000 to 2000°K) reveal marked deviations from the cosine law. It would appear that complete thermodynamic equilibrium is seldom achieved in a high-temperature Knudsen experiment; further, in terms of ordinary kinetic theory, descriptions of the behavior of the "gas" inside the cell are oversimplified. The measured distributions show clearly, in a fashion analogous to the formation of an image by a pinhole camera, the effects of geometry and choice of materials for each Knudsen cell. In particular, containment problems which force the use of special cell materials at high temperatures may introduce side effects which can cause serious deviations from theory. In

order to augment experimental studies, a Monte Carlo program was formulated for the Los Alamos MANIAC computer to attempt to duplicate mathematically the experimental results. The assumptions used in designing the computer program were derived from the experimental work. A cell model was constructed which allowed assignment of probabilities, on the basis of sample and cell geometries, corresponding to events thought to occur in the real case. It was found that the distributions predicted by the computer agreed very closely with those obtained experimentally. Explanations are offered for the results that were observed, and suggestions are made as to how some of these results might be used to improve the reliability of Knudsen data. Author

N67-10753*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF LIQUID SLOSHING IN A SCALE-MODEL CENTAUR LIQUID-HYDROGEN TANK

Irving E. Sumner, Raymond F. Lacovic, and Andrew J. Stofan Washington, NASA, Nov. 1966 33 p refs
(NASA-TM-X-1313) CFSTI: HC $2.00/MF $0.50 CSCL 20D

An investigation was conducted to determine the sloshing characteristics and slosh damping effectiveness of the following ring baffle configurations: (1) a flat-ring baffle, (2) a scale model of a preliminary baffle configuration for the Centaur liquid hydrogen tank consisting of a channeled ring and 3 bracket supports, and (3) a scale model of the AC-8 baffle configuration consisting of a channeled ring, 12 equally spaced vertical baffles, 12 baffle stiffners, and 3 equally spaced bracket supports. Experimental values of (1) the fundamental frequencies of the liquid oscillations and (2) the horizontal slosh forces and damping ratios occurring at the fundamental frequencies were obtained for both the unbaffled and the baffled tank configurations for a range of liquid levels above the top of the concave oblate spheroidal tank bottom. Experimental values of the frequencies, horizontal slosh forces, and damping ratios at the first two natural frequencies of the liquid oscillations were determined for liquid levels below the top of the concave oblate spheroidal tank bottom. The measurement of both the vertical and the horizontal slosh forces provided pendulum analogy parameters that would effectively represent liquid sloshing in the unbaffled tank configuration. Author

N67-10754*# National Aeronautics and Space Administration, Washington, D. C.

THEORETICAL STUDY OF TURBULENT SALINE DIFFUSION IN A CONDUIT IN CONTINUOUS SERVICE [ETUDE THEORIQUE DE DIFFUSION SALINE TURBULENTE EN CONDUITE EN REGIME PERMANENT]

Roger Lievre Aug. 1964 5 p Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 244, 1957 p 1611–1614
(NASA-TT-F-9098) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The distribution of concentration in a point-type injection is obtained by solving the diffusion equation, after which the effect of hypothetical calculations on the solutions arrived at is examined. Author

N67-10793*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

BAFFLE THICKNESS EFFECTS IN FUEL SLOSHING EXPERIMENTS

Henry A. Cole, Jr. Washington, NASA, Nov. 1966 14 p refs
(NASA-TN-D-3716) CFSTI: HC $1.00/MF $0.50 CSCL 20D

Measured damping forces on fuel sloshing baffles of varying thickness are presented from tests conducted with water in a two-dimensional tank and a cylindrical tank. The results show that baffle thickness decreases baffle effectiveness by as much as 50 percent at moderate amplitudes of oscillation. Ink-trace experiments conducted in the two-dimensional tank show baffle thickness effects on flow similarity. These results are used to show the mechanism by which baffle thickness affects damping. A table of critical thickness for flow similarity is given to serve as a guide to designers and experimenters. Author

N67-10808# European Atomic Energy Community, Ispra (Italy). Engineering Dept.

CONVERSION OF LEAK FLOW-RATES FOR VARIOUS FLUIDS AND DIFFERENT PRESSURE CONDITIONS

J. Amesz May 1966 30 p refs
(EUR-2982.e)

The development of rules for conversion of gas and liquid leakages is presented. In many cases, for reasons of convenience, leaktightness of components is tested by means of a gaseous medium, although they actually operate with a liquid medium. As leak mechanisms of a liquid and a gas are often principally different, conversion requires the application of appropriate correlations. Based on theoretical considerations, such correlations are derived and presented. Author (NSA)

N67-10979# Polytechnic Inst. of Brooklyn, Freeport, N. Y.

APPLICATION OF LINEARIZED CHARACTERISTICS TO A THREE-DIMENSIONAL NOZZLE FLOW

Arthur J. Schlesinger Wright-Patterson AFB, Ohio, ARL, Jun. 1966 32 p refs
(Contract AF 33(657)-8286)
(PIBAL-866; ARL-66-0107; AD-639330) CFSTI: HC $2.00/MF $0.50

The method of three-dimensional linearized characteristics was applied to the design of annular supersonic nozzles. The equations and coordinate system used are presented along with a step-by-step calculation procedure of the method. A typical nozzle was designed which produces a radial variation in the exit mach number and flow deflection. The results are presented in terms of the two-dimensional and final three-dimensional nozzle contours in three radial planes. The method and system of equations presented are applicable to guide vanes or stators with large turning angles and high tangential components of velocity. Author (TAB)

N67-10995# ARO, Inc., Arnold Air Force Station, Tenn.

CHARTS OF NORMAL SHOCK WAVE PROPERTIES IN IMPERFECT NITROGEN (SUPPLEMENT: M_s = 1 TO 10)

Clark H. Lewis and E. G. Burgess, III Arnold Eng. Devel. Center, Sep. 1966 58 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-116; AD-637852) CFSTI: HC $3.00/MF $0.75

Gas dynamic properties which include the effects of dissociation and intermolecular forces (van der Waals) are presented for incident and reflected shock waves in equilibrium imperfect nitrogen. Charts are presented for incident shock Mach numbers in the range from 1 to 10 into (ideal) nitrogen at a temperature of 300K and pressures in the range from 0.0001 to 1000 cm Hg. The temperature and density in any region do not exceed, respectively, 15,000K and 1000 amagats. In addition to the usual incident and reflected shock properties, stagnation conditions upstream and downstream and conditions immediately downstream of a standing shock wave are also presented. At pressures above one atmosphere in the undisturbed gas, the effects of the intermolecular forces on the gas dynamic properties are demonstrated. Author (TAB)

N67-11011# RAND Corp., Santa Monica, Calif.

THE INCOMPRESSIBLE LAMINAR AXISYMMETRIC WAKE

S. A. Berger Aug. 1966 41 p refs
(Contract ARPA SD-79; ARPA Order 189-1)
(RM-4860-ARPA; AD-639130) CFSTI: HC $2.00/MF $0.50

The memorandum considers the asymptotic development of the axisymmetric incompressible wake far behind a long, thin cylinder. This is the axisymmetric analogue of the classical two-dimensional flat-plate problem; however, the resulting solution is applicable to a wider class of axisymmetric bodies. In Section II an asymptotic expansion in inverse powers of the axial distance downstream of the cylinder is attempted. In Section III the

axisymmetric problem is reformulated, and it is shown that as in the two-dimensional problem the cause of the breakdown of the solution given in Section II is the existence of a logarithmic term in the second-order approximation. TAB

N67-11022# Michigan Univ., Ann Arbor.
AN EXPERIMENTAL STUDY OF THE INFLUENCE OF LOCALIZED, NORMAL SURFACE OSCILLATIONS ON THE LAMINAR FLOW OVER A FLAT PLATE
James M. Deimen and John A. Clark Wright-Patterson AFB, Ohio, ARL, Jan. 1966 152 p refs
(Contract AF 33(657)-8368)
(ARL-66-0010; pt. VI; AD-639444) CFSTI: HC $5.00/MF $1.00

The purpose of the investigation is to study the effect of a finite localized surface oscillation on the mean value velocity profiles in the laminar boundary layer of a flat plate and compare the results with an analytic solution. The experimental program consisted of the design, construction and testing of a flat plate with a flexible membrane located in the surface and driven by an oscillating device. The flat plate was located in a low turbulence, low speed wind tunnel. The principal measuring instrument was a hot wire anemometer. Experimental data was taken at free stream velocities of 20 and 40 feet per second. The surface oscillation amplitude was 0.050 inches and the frequency range 15 to 100 cycles per second. The results of the investigation show that a definite change in the mean value velocity profile in laminar flow occurs and is a function of free stream velocity, frequency and location on the plate surface. In addition, early transition is promoted despite the fact that the disturbance test range was within the Tollmien-Schlichting stability area. The analytic solution is found to be qualitatively valid in the laminar flow region downstream of the membrane Author (TAB)

N67-11029# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ELECTRON BEAM STUDIES OF THE DIFFUSIVE SEPARATION OF HELIUM-ARGON MIXTURES IN FREE JETS AND SHOCK WAVES
Dietmar E. Rothe Jul. 1966 115 p refs
(Grant AF-AFOSR-276-65; DRB-G-9550-05)
(UTIAS-114; AD-639592) CFSTI: HC $4.00/MF $0.75

A narrow electron beam was used to selectively determine the component densities in rarefied helium-argon flows by spectrally analyzing the beams luminescence. After a systematic study of the electron beam fluorescence in helium and argon was made in a series of preliminary experiments, point-by-point measurements were made along and off the axes of underexpanded free jets and through normal shock waves produced by shock holders placed in the jets. Various argon mole fractions were used, and the jet Reynolds number ranged from 100 to 10,000. The argon enrichment found along the jet axis agrees well with a theory recently proposed by F. S. Sherman. Off axis tests show an argon deficiency near the jet boundary. The experimental shock profiles agree only qualitatively with one-dimensional theories. Radial diffusion destroyed the otherwise approximate one-dimensionality of the shock waves, resulting in a significant argon enrichment inside the partially stagnated shock holder Author (TAB)

N67-11136# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.
COMPREHENSIVE CAVITATION DAMAGE DATA FOR WATER AND VARIOUS LIQUID METALS INCLUDING CORRELATIONS WITH MATERIAL AND FLUID PROPERTIES Technical Report No. 6
Ramon Garcia (Ph.D. Thesis) Aug. 1966 392 p refs
(Grant NSF F-22529)
(Rept.-05031-6-T)

Efforts to obtain a better understanding of the cavitation-erosion phenomenon are described. Cavitation resistance was determined for a wide variety of useful materials that represent a range of mechanical properties. A comprehensive correlation of the cavitation damage data with applicable material and fluid properties was obtained utilizing a suitable computer program. Development of a relationship between the damage incurred in a flowing venturi device and the damage obtained in an accelerated vibratory facility is discussed. Studies indicated that the tantalum-base alloys were the most cavitation resistant of the materials tested at elevated temperatures. Stainless steels were the most resistant in mercury at 70°F. In general, the best correlations included one or more energy-type mechanical property, one or more strength-type property, and one or more fluid coupling parameter, such as the fluid density or bulk modulus. Tests indicated the feasibility of the accelerated vibratory results in interpreting cavitation experiments in flowing systems. S.P.

N67-11139# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
WAVES IN FLUID-FILLED ELASTIC TUBES
John H. Olsen Jun. 1966 62 p refs
(Grant NIH HD-01288)
(Rept.-66-5)

A theoretical and experimental study of large amplitude, long wave-length motions of a viscous liquid in long elastic tubeswas performed. A one-dimensional model for the flow in which the tube wall moves only radially, and in which only longitudinal pressure gradients and fluid accelerations are important is presented. The effects of fluid viscosity are treated for both laminar and turbulent flow. The governing nonlinear equations are solved by several methods, and the solutions are compared with each other and with a set of accurate experimental data. The results indicate that nonlinear effects due to large amplitude motion are not as large as those found in similar problems in gas dynamics and water waves. Author

N67-11140# Library of Congress, Washington, D. C. Aerospace Technology Div.
ON OPERATION OF PUMPS AND BLOWERS UNDER REDUCED FEED REGIMES [O RABOTE NASOSOV I VOZDUKHODUVNYKH MASHIN NA REZHIMAKH PONIZHENNYKH PODACH]
V. I. Polikovskiy and A. A. Levin 28 Jun. 1966 10 p refs
Transl. into ENGLISH from Teploenerg. (Moscow), no. 10, 1965 p 71-74
(ATD-66-94)

The mechanism of the process of liquid flow towards a rotor under reduced feed regimes is examined. A postulate is introduced for maintaining the angle of attack of the incoming flow under these regimes. The author emphasizes the fact that the solution of this problem will permit a rational approach to optimizing a number of the geometric parameters of impellers, presently determined on the basis of far-from-precise, purely experimental recommendations. Author

N67-11153# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTATION OF THE TRAJECTORY OF A JET IN A DRIFTING FLOW
S. V. Vakhlamov 13 Jun. 1966 12 p refs Transl. into ENGLISH from Inzh.-fiz. Zh. (Minsk), v. 7, no. 10, 1964 p 112-116
(FTD-TT-65-1977; TT-66-62285; AD-639159) CFSTI: HC $1.00/MF $0.50

A method is expounded for computing the trajectory of a jet in a lateral flow based on the application of the equation of the amount of motion in projections onto the axes of coordinates. Author (TAB)

N67-11188# RAND Corp., Santa Monica, Calif.
THE APPLICATION OF THE PLK METHOD TO THE INCOMPRESSIBLE LAMINAR AXISYMMETRIC FAR WAKE

S. A. Berger Aug. 1966 18 p refs
(Contract ARPA SD-79; ARPA Order 189-1)
(RM-4859-ARPA; AD-639131) CFSTI: HC $1.00/MF $0.50

An attempted asymptotic series solution in terms of inverse powers of the axial distance for the incompressible laminar wake far behind a very slender cylinder breaks down at an early stage. The PLK method is applied to the problem and yields a uniformly valid asymptotic solution. The method of approach used should be of interest to researchers in fluid mechanics concerned with the solution of singular perturbation problems, while the results should be of interest to those involved in wake studies. Author (TAB)

N67-11195# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
BOUNDARY-LAYER OSCILLATIONS OVER A RESONANT SURFACE
Peter B. Rhines and Erik L. Mollo-Christensen Feb. 1966 46 p refs
(Contract Nonr-1841(89))
(ASRL-TR-116-2; AD-638727) CFSTI: HC $2.00/MF $0.50

The boundary layer is observed in low-speed flow over a dispersively-coupled system of acoustic resonators. It is found that oscillations in the laminar layer are strongly excited by this model of a passive, flexible, wall. The geometry of this process differs from that expected with a real membrane, however, due to the details of the wall construction. A different set of laminar oscillations dominates the flow over the middle of the surface, producing turbulence in a manner controlled by the spanwise variations in the wall. The importance of the nature of this transition process to other shearing flows is discussed. Author (TAB)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N67-10007# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: DAPANGO (TOGO), AUGUST 1965 [IONOSPHAEREN-DATEN VERTIKAL-ECHO-LOTUNG: DAPANGO (TOGO), AUGUST 1965]
[1965] 17 p ref In GERMAN and ENGLISH
CFSTI: HC $1.00/MF $0.50

Tables of ionospheric vertical echo sounding data are presented. These tables include the ordinary wave critical frequency for the F-2, F-1, E, and Es layers; the blanketing frequency of the Es layer; the lowest frequency which shows vertical ionospheric reflections; and the minimum virtual height on the ordinary wave branch of the Es, E, R-2, and F layers. C.T.C.

N67-10012# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SOUNDING: DAPANGO (TOGO), SEPTEMBER 1965 [IONOSPHAEREN-DATEN VERTIKAL-ECHO-LOTUNG: DAPANGO (OGO), SEPTEMBER 1965
[1965] 17 p ref In GERMAN and ENGLISH
CFSTI: HC $1.00/MF $0.50

Ionospheric vertical echo sounding data are presented in tabular form. Included in these tables are the ordinary wave critical frequency for the F-2, F-1, E, and Es layers; the blanketing frequency of the Es layer; the lowest frequency which shows vertical ionospheric reflections; and the minimum virtual height on the ordinary wave branch for the Es, E, F-2, and the whole F layer. C.T.C.

N67-10020# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, ABSORPTION-MEASUREMENTS: FREIBURG, URSI-CODE 131, JANUARY-JUNE 1966 [IONOSPHAEREN-DATEN ABSORPTIONS-MESSUNGEN: FREIBURG, URSI-CODE 131, JANUAR-JUNI 1966]
[1965] 14 p refs In GERMAN Sponsored by West Ger. Min. of Com.
(Rept.-15) CFSTI: HC $1.00/MF $0.50

Ionospheric absorption data for the months January through June, 1966, were obtained by automatic echo registration and are presented in table form. Measurements of three minute duration were repeated eight times during periods of half hours; and mean daily values were found for eight different frequencies. Transl. by G.G.

N67-10027# Ionospharen-Institut Breisach (West Germany).
IONOSPHERE DATA, VERTICAL-ECHO-SUMMARY: FREIBURG, URSI-CODE 131, JANUARY-MARCH 1966 [IONOSPHAEREN-DATEN VERTIKAL-ECHO-LOTUNG: FREIBURG, URSI-CODE 131, JANUAR-MAERZ 1966]
[1966] 120 p In GERMAN and ENGLISH
(Rept.-235-F, Rept.-236-F, Rept.-237-F) CSFTI: HC $4.00/MF $0.75

Data from ionograms of the E and F layers of the ionosphere are presented. An explanation of the symbols used precedes the tabulated data. H.S.W.

N67-10036# Belgian Royal Observatory, Uccle.
EXPERIMENTAL DETERMINATION OF THE DYNAMIC EFFECTS OF THE TERRESTRIALLIQUID CORE IN THE DIURNAL EARTH TIDES [DETERMINATION EXPERIMENTALE DES EFFETS DYNAMIQUES AU NOYAU LIQUIDE DE LA TERRE DANS LES MAREES TERRESTRES DIURNES]
Paul Melchior 1966 9 p refs Repr. from Bull. Acad. Roy. Belgique (Brussels), 8 Jan. 1966 p 93–100 In FRENCH *Its* Ser. Geophys. No. 73
CFSTI: HC $1.00/MF $0.50

Six recordings of the horizontal East-West component of the force of earth tides were made with four quartz horizontal clocks of very high, stable accuracy. The harmonic analysis of these uninterrupted long series of observations furnished important results for the K_1 lunisolar, P_1 larger sloar, and O_1 larger lunar, diurnal coordinates of the tide which confirm theoretical coefficients and are based on the consideration of dynamic effects of the liquid core of the earth. Transl. by R.Ll.

N67-10057# Pisa Univ. (Italy). Faculty of Engineering.
GRAPHIC METHOD FOR THE CALCULATION OF TOPOGRAPHIC REDUCTION IN GRAVITY MEASUREMENTS IN THE HYPOTHESIS OF A SPHERICAL EARTH. (EXTENSION TO ALL ZONES INDICATED BY LETTERS) [METODO GRAFICO PER IL CALCOLO DELLA RIDUZIONE TOPOGRAFICA NELLE MISURE DI GRAVITA' NELL'IPO-TESI DELLA TERRA SFERICA. (ESTENSIONE A TUTTE LE ZONE INDICATE CON LETTERA)]
Brunetto Palla 1965 17 p refs In ITALIAN; ENGLISH summary *Its* Ser. 23, No. 1109
(Publ.-59) CFSTI: HC $1.00/MF $0.50

In gravity measurements, the topographical values obtained by using a graph showing the constant densities of the continent and of the ocean confirm previous studies. The criteria for the method used, and the procedure to be followed in the topographical reduction are outlined. Values obtained by extending the calculation to the zone indicated by letters and following a hypothetical profile, are found to be always lower than 0.05 mgal. Results obtained by this calculation method are compared with those attainable from existing tables. Transl. by R.Ll.

N67-10161# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELEN, NOVEMBER–DECEMBER 1962 [DONNEES IONOSPHERIQUES DE KERGUELEN, JANVIER–FEVRIER 1962]
[1962] 48 p ref In FRENCH CFSTI: HC $2.00/MF $0.50

Ionospheric sounding data from ionograms made at Kerguelen, for November and December 1961 are presented. Duration of sweep, pulsed signal strength, magnetic inclination, and geographic and geomagnetic coordinates for the ionospheric reporting station are listed. Terminology and symbols describing the ionospheric characteristics are fully explained according to the conventions agreed upon during the International Geophysical Year. Average hourly values of the period are given for frequency characteristics, altitudes, maximum usable frequency, and for the D, E, and F layers. Transl. by R.Li.

N67-10162# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELEN, JANUARY–FEBRUARY 1962 [DONNEES IONOSPHERIQUES DE KERGUELEN, JANVIER–FEVRIER 1962]
[1962] 52 p ref In FRENCH For Abstract See N67-10161 01-13
CFSTI: HC $3.00/MF $0.50

N67-10163# Group de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELEN, MARCH–APRIL 1962 [DONNEES IONOSPHERIQUES DE KERGUELEN, MARS–AVRIL 1962]
[1962] 50 p ref In FRENCH For Abstract See N66-10161 01-13
CFSTI: HC $3.00/MF $0.50

N67-10164# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELEN, MAY–JUNE 1962 [DONNEES IONOSPHERIQUES DE KERGUELEN, MAI–JUIN 1962]
[1962] 52 p ref In FRENCH For Abstract See N67-10161 01-13
CFSTI: HC $3.00/MF $0.50

N67-10165# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELIN, JULY–AUGUST, 1962 [DONNEES IONOSPHERIQUES DE KERGUELEN, JUILLET–AOUT 1962]
[1962] 52 p ref In FRENCH For Abstract See N67-10161 01-13
CFSTI: HC $3.00/MF $0.50

N67-10166# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELEN, SEPTEMBER–OCTOBER 1962 [DONNESIONO SPHERIQUES DE KERGUELEN, SEPTEMBRE–OCTOBRE 1962]
[1962] 52 p ref In FRENCH For Abstract See N67-10161 01-13
CFSTI: HC $3.00/MF $0.50

N67-10167# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF KERGUELEN, NOVEMBER–DECEMBER 1962 [DONNEES IONOSPHERIQUES DE KERGUELEN, NOVEMBRE–DECEMBRE 1962]
[1963] 54 p ref In FRENCH For Abstract See N67-10161 01-13
CFSTI: HC $3.00/MF $0.50

N67-10168# Groupe de Recherches Ionospheriques, Issy-les-Molineaux (France).
IONOSPHERIC DATA OF ADELIE COAST, MARCH 1963 [DONNEES IONOSPHERIQUES DE TERRE ADELIE, MARS 1963]
[1963] 30 p ref In FRENCH CFSTI:
CFSTI: HC $2.00/MF $0.50

Ionograms of sounding data made at Terre Adelie, for March 1963, are analyzed. Listed for the ionospheric reporting station are details on: geographic and geomagnetic coordinates, duration of sweep, pulsed signal strength, and magnetic inclination. Average hourly values of the period are given for frequency characteristics, altitudes, maximum usable frequency, as well as for other characteristics of D, E, and F layers. Symbols and terminology describing the ionospheric characteristics are fully explained according to the conventions agreed upon during the International Geophysical Year. Transl. by R.Li.

N67-10169# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
IONOSPHERIC DATA OF ADELIE COAST, APRIL 1963 [DONNEES IONOSPHERIQUES DE TERE ADELIE, AVRIL 1963]
[1963] 30 p ref In FRENCH For Abstract See N66-10168 01-13
CFSTI: HC $2.00/MF $0.50

N67-10170# Group de Recherches Ionospheriques, Issy-les-Moulineaux (France).
IONOSPHERIC DATA OF ADELIE COAST, MAY–JUNE 1963 [DONNEES IONOSPHERIQUES DE TERRE ADELIE, MAI–JUIN 1963]
[1963] 54 p ref In FRENCH For Abstract See N66-101068 01-13
CFSTI: HC $2.00/MF $0.50

N67-10171# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France)
IONOSPHERIC DATA OF ADELIE COAST, JULY–AUGUST 1963 [DONNEES IONOSPHERIQUES DE TERRE ADELIE, JUILLET–AOUT 1963]
[1963] 54 p ref In FRENCH For Abstract See N66-10168 01-13 CFSTI: HC $3.00/MF $0.50

N67-10172# Groupe de Recherches Ionospheriques, Issy-les-Moulineaux (France).
IONOSPHERIC DATA OF ADELIE COAST, NOVEMBER–December 1963 [DONNESS IONOSPHERIQUES DE TERRE ADELIE, NOVEMBRE–DECEMBRE 1963]
[1964] 50 p ref In FRENCH For Abstract See N66-10168 01-13
CFSTI: HC $2.00/MF $0.50

N67-10182*# National Aeronautics and Space Administration, Washington, D. C.
THERMAL RADIATION EFFECTS IN THE UPPER ATMOSPHERE
K. Y. Kondrat'yev [1962] 26 p refs Transl. into ENGLISH of the paper presented at the COSPAR 3d Intern. Space Sci. Symp., Washington, D. C., May 1962
(NASA-TT-F-8412) CFSTI: HC $2.00/MF $0.50 CSCL 04A

It is pointed out that to explain the isothermal conditions in the stratosphere by the existence of a state of radiative equilibrium in this layer, a number of theories were advanced. The problem of thermal radiation effects in the upper atmosphere is reviewed in the light of the conclusion that radiation is one of the major factors in the thermal regime of the upper atmosphere. Examples of the processes taking place in different atmospheric layers are presented. Graphs and mathematical expressions show the results of calculations of the temperature distributions. Comparisons by different authors of temperature distribution curves based on different atmospheric models are included. R.Li.

N67-10201*# National Aeronautics and Space Administration, Washington, D. C.
THE STRUCTURE OF CHONDRULES AND CHONDRITES
L. G. Kvasha May 1966 43 p refs Transl. into ENGLISH from Meteoritika (Moscow), no. 26, 1965 p 35–57
(NASA-TT-F-10129) CFSTI: HC $2.00/MF $0.50 CSCL 08G

Investigations on the structure of chondrules in chondritic meteorites, on the basis of granolumetric, gravitational, and magnetic analyses of detrital rocks and slimes for defining the nature of the interstitial silicate, nickel-iron, and troilite, are discussed. Tabulated and plotted data on various chondrites fallen in Russia indicate that the chondrules were formed from drops of liquid (melting of finely divided solids, condensation of gases), that formation of the impurities (sulfides, etc.) took place after solidification of the chondrules, and that the interstitial silicates were formed from the detritus of the glass constituents of the chondrules. Author

N67-10204*# National Aeronautics and Space Administration, Washington, D. C.
SPACE PHOTOGRAPHY FOR THE GEOGRAPHICAL STUDY OF THE EARTH [KOSMICHESKAYA FOTOGRAFIYA DLYA GEOGRAFICHESKOGO IZUCHENIYA ZEMLI]
B. V. Vinogradov Aug. 1966 23 p refs Transl. into ENGLISH from Izv. Vses. Geogr. Obshchestva (USSR), v. 98, no. 2, 1966 p 101–111
(NASA-TT-F-10246) CFSTI: HC $1.00/MF $0.50 CSCL 08B

The article presents a historical review of the various means of space photography. These include photographs taken from research rockets, spacecraft and artificial Earth satellites. The author points out that the quality of the photographs is not as high as it could be, because none of the space vehicles was especially designed to photograph the surface of the Earth; this task was only an additional operation in the flight program. Author

N67-10210*# National Aeronautics and Space Administration, Washington, D. C.
MEASUREMENT OF THE ATMOSPHERIC TURBULENCE INNER SCALE BETWEEN 80 AND 100 KM MEDIDA DE LA ESCALA INTERNA DE TURBULENCIA ATMOSFERICA ENTRE 80 Y 100 KM. DE ALTURA]
H. Teitelbaum Oct. 1966 12 p refs Transl. into ENGLISH of Comision Nacl. de Invest. Espaciales Tech. Publ. no. 7 Presented at the COSPAR Meeting, Mar del Plata, Argentina, May 1965
(NASA-TT-F-10300) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Theoretical considerations are presented, introducing the structure function and establishing its form connection with the so-called inner scale as a function of dissipated energy and kinematic viscosity. This theory is then used to determine the inner scale of the atmospheric turbulence by means of alkaline clouds; experimental techniques and data are presented. Author

N67-10211*# National Aeronautics and Space Administration, Washington, D. C.
PRESENT STATE OF THE PROBLEM OF NOCTILUCENT CLOUDS
I. A. Khvostikov Oct. 1966 14 p refs Transl. into ENGLISH from Meteorol. Issled., Serebristyye Oblaka (Moscow), sect. 2, no. 12, 1966 p 5–10
(NASA-TT-F-10301) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The author discusses some aspects of the dynamics of the upper atmosphere in connection with noctilucent cloud investigations: wave movements in the mesopause, inner gravitational waves and turbulent diffusion in the upper atmosphere. The possibility of hydrodynamic influence of the tropospheric processes on the state of the atmosphere at the level of the mesopause and the consequent formation of noctilucent clouds is considered. In connection with these facts a possible role of the inner gravitational waves is pointed out. Author

N67-10212*# National Aeronautics and Space Administration, Washington, D. C.
THE NATURE OF NOCTILUCENT CLOUDS AND CERTAIN QUESTIONS CONCERNING THE PHOTOCHEMISTRY AND DYNAMICS OF THE EARTH'S ATMOSPHERE [PRIRODA SEREBRISTYKH OBLAKOV I NEKOTORYYE VOPROSY FOTOKHIMII I DINAMIKI ZEMNOY ATMOSFERY]
I. A. Khvostikov Oct. 1966 19 p refs Transl. into ENGLISH from Meteorol. Issled., Serebristyye Oblaka (Moscow), sect. 2, no. 12, 1966 p 57–65
(NASA-TT-F-10302) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The report discusses the presence of ice as component of noctilucent cloud particles and the low humidity of air in the mesosphere. The report indicates the three possibilities which explain the episodical rise of the humidity precipitation on the condensation centers of noctilucent cloud particles. One of these possibilities is a formation of additional quantities of H_2O molecules directly in the mesosphere. One of the mechanisms is related to the role of corpuscular solar streams in the increase of the hydrogen concentration at the height of 100 km in relation to modern data on solar wind ("solar rain"). The other mechanism is related to the influence of the dynamic factors. Author

N67-10213*# National Aeronautics and Space Administration, Washington, D. C.
MEASUREMENTS OF HUMIDITY IN THE UPPER ATMOSPHERE [IZMERENIYA VLAZHNOSTI V VERKHNIKH SLOYAKH ATMOSFERY]
I. Ya. Badinov, S. D. Andreyev, and V. B. Lipatov Oct. 1966 33 p refs Transl. into ENGLISH from Meteorol. Issled., Serebristyye Oblaka (Moscow), sect. 2, no. 12, 1966 p 66–79
(NASA-TT-F-10303) CFSTI: HC $2.00/MF $0.50 CSCL 04A

This report contains a critical summary of measurements of the atmospheric humidity in its upper layers made by automatic balloon solar spectrophotometers. The instruments registered the solar spectrum within the wide region of 0.4–13μ. The spectra up to 25–28 km were recorded. The integral content of water vapor above different levels was defined by the bands 0.94, 1.13, 1.39, 1.87 and 6.3μ. About 1μ of water vapor was found above the level of 28 km on 23 October; other ascents confirmed a small content of water vapor in the stratosphere (the order of 10^{-6}g/g). The authors have come to the conclusion that the humidity increase with height is caused by the pollution brought in by the balloon and the apparatus. Analysis of all recent results of the measurements allows us to consider the conception of a humid stratosphere as groundless. Author

N67-10214*# National Aeronautics and Space Administration, Washington, D. C.
INTERPRETING THE RESULTS OF ROCKET SOUNDING OF NOCTILUCENT CLOUDS [OB INTERPRETATSII REZUL'TATOV RAKETNOGO ZONDIROVANIYA SEREBRISTYKH OBLAKOV]
V. D. Reshetov and I. A. Khvostikov Oct. 1966 9 p refs Transl. into ENGLISH from Meteorol. Issled., Serebristyye Oblaka (Moscow), sect. 2, no. 12, 1966 p 80–83
(NASA-TT-F-10304) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The investigation of noctilucent clouds by rockets requires an elaboration of the interpretation theory of the measurement results. A greater number of particles on the day of the launch to the noctilucent clouds can be explained by the fact that dry dust specks flow around the rocket detector together with the oncoming air stream, while the dust specks with ice crusts, being of a larger mass, are not so easily carried away by the oncoming stream. We should also take into account the increase of meteor activity from 7 to 11 of August. The considered effect of the flow by the oncoming stream around the detector can also explain the increase of a relative content of small dust specks during the launch to the cloud. The report also indicates the influence of the boundary

layer of strongly heated air at the rocket head and the detector, the scouring of the rocket and the change of the angle of attack. Author

N67-10215*# National Aeronautics and Space Administration, Washington, D. C.
TEMPERATURE OF THE ATMOSPHERE IN THE REGION OF THE MESOPAUSE AND DISTRIBUTION OF NOCTILUCENT CLOUDS [TEMPERATURA ATMOSFERY V OBLASTI MEZOPAUZY I RASPREDELENIYE SEREBRISTYKH OBLAKOV]
V. V. Mikhnevich Oct. 1966 10 p refs Transl. into ENGLISH from Meteorol. Issled., Serebristyye Oblaka (Moscow), sect. 2, no. 12, 1966 p 84–87
(NASA-TT-F-10305) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The report considers seasonal and latitudinal dependence of temperature in order to investigate the correlation between temperature mesopause and noctilucent cloud distribution. The existence of the full correlation of such a type is established. This fact confirms the great role of temperature in noctilucent cloud formation. Author

N67-10216*# National Aeronautics and Space Administration, Washington, D. C.
DYNAMICS OF THE ATMOSPHERE AND NOCTILUCENT CLOUDS [DINAMIKA ATMOSFERY I SEREBRISTYYE OBLAKA]
B. A. Mirtov Oct. 1966 9 p refs Transl. into ENGLISH from Meteorol. Issled., Serebristyye Oblaka (Moscow), sect. 2, no. 12, 1966 p 88–91
(NASA-TT-F-10306) CFSTI: HC $1.00/MF $0.50 CSCL 04A

The report considers the existing data on the dynamic processes in the upper atmosphere. The defining process for the atmosphere mixing at the altitudes of 60-100 km is the process of an intensive large-scaled turbulent mixing. It is stated that the dust layer in the noctilucent cloud zone cannot be stable. The turbulent mixing hinders the formation of a narrow stable dust layer at the mesopause level and promotes the formation of a cloud layer of ice origin. Author

N67-10319# Woods Hole Oceanographic Institution, Mass.
TRACK CHARTS, BATHYMETRY, AND LOCATION OF OBSERVATIONS, CHAIN CRUISE No. 51, NORTH ATLANTIC OCEAN PROJECT SEA SPIDER, PART I Technical Report, 22 Jul.–31 Aug. 1965
William M. Dunkle and Frances M. Dakin, comp. Dec. 1965 30 p
(Contract Nonr-4029(00))
(WHOI-66-2; AD-637988) CFSTI: HC $3.00/MF $0.75

This report contains charts of Cruise 51 of CHAIN in the North Atlantic Ocean. There are 22 charts plotted on a Mercator Projection (scale 1 degree longitude equals 4 inches) showing the track of the entire cruise except for the area within 5 miles of Project Sea Spider on the Blake Plateau. All types of observations made during the cruise are noted by suitable symbols or legends and are shown on Index Charts. Soundings are read at equal time intervals, usually every five minutes, and at each break in slope. They are written along the ship's track as often as space permits. Author (TAB)

N67-10326# Avco Corp., Wilmington, Mass. Research and Technology Labs.
GUIDED INFRASONIC MODES IN A TEMPERATURE-AND WIND-STRATIFIED ATMOSPHERE Scientific Report No. 6
Allan D. Pierce 1 Sep. 1966 44p refs
(Contract AF 19(628)-3891)
(AVSSD-0175-66-CR; AFCRL-66-568; AD-637874) CFSTI: HC $2.00/MF $0.50

The propagation of infrasonic waves in a realistic model atmosphere which includes a variable wind profile as well as a variable temperature profile is discussed quantitatively for wave periods between 1 and 10 minutes. The numerical method used for the computation of phase and group velocity curves and other characteristic quantities associated with the possible guided modes is an extension of the multilayer method used previously by Press and Harkrider and by Pfeffer and Zarichny for atmospheres without winds. The effects of winds on the propagation are assessed by examining computations carried out for various fixed directions of the horizontal group velocity and from the computation of deviations of the phase velocity direction from group velocity direction for the case of propagation crosswind. Pressure–height profiles of various frequencies propagating in various modes are exhibited and excitation amplitudes for ground level sources (excluding the frequency spectrum of the source) are plotted versus frequency for various modes and various group velocity directions. Qualitative explanations of the computed results are given and the implications of the results to actual waveforms are discussed. Author (TAB)

N67-10374# Air Force Cambridge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
PERSISTENCE OF SMALL-SCALE FEATURES IN THE MESOSPHERIC WIND FIELD
Bernhard Lettau May 1966 17 p refs *Its* Environ. Res. Paper No. 198
(AFCRL-66-371; AD-637718) CFSTI: HC $1.00/MF $0.50

A special series of nine paired ROBIN falling sphere soundings was obtained over a six-hour period on 6 March 1965, as part of an investigation into the small-scale features of the wind field in the upper stratosphere and lower mesosphere. These soundings allow a simultaneous analysis of the temporal and spatial extent of the observed wave-like variations of the zonal wind. In the mesosphere (the altitude interval between 45 and 60 km) such variations are persistent. Individual features are followed throughout the six-hour observation program, and laterally extended. Soundings separated by 50 km show quite good correspondence among gross features. The interpretation of the wind oscillations as evidence of internal waves is considered, and horizontal and vertical wave parameters are determined. Vertical wavelengths are computed to be of the order of 3 km, while horizontal wave lengths are determined to be about 400 km, leading to a horizontal/vertical scale ratio of 120:1. There are also suggestions of horizontal and vertical wave amplitudes of about 5 m/sec and 4 cm/sec, and periods of oscillation of about 13 hours Author (TAB)

N67-10383# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, No. 143
2 Nov. 1966 31 p refs Transl. into ENGLISH from Sino-Soviet publ.
(JPRS-38460; TT-61-11147-143) CFSTI: $4.00

A collection of abstracts, summaries, and full translations of Soviet research articles is presented. The research is concerned with the areas of astronomy, meteorology, oceanography, terrestrial geophysics, the upper atmosphere, and space. Complete bibliographic information accompanies each article. R.N.A.

N67-10384# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, No. 142
18 Oct. 1966 69 p refs Transl. into ENGLISH from Sino-Soviet publ.
(JPRS-38230; TT-61-11147-142) CFSTI: $3.00

A compilation of abstracts, summaries, and full translations of articles dealing with Soviet research in astronomy, meteorology, oceanography, terrestrial geophysics, the upper atmosphere and space, and miscellaneous areas such as glaciers, water bodies without life, and Antarctica is presented. Complete bibliographic information accompanies each article. R.N.A.

N67-10385# Joint Publications Research Service, Washington, D. C.

STUDY OF VOLUME SOUND SCATTERING IN THE OCEAN AND MEASUREMENT OF THE ACOUSTIC CHARACTERISTICS OF SCATTERING LAYERS

I. B. Andreyeva 28 Oct. 1966 17 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 6, no. 4, 1966 p 599–607
(JPRS-38379; TT-66-34805) CFSTI: $1.00

A modified acoustic method for measuring the averaged acoustical characteristics of layers of air bubbles formed by the wind which lie adjacent to the ocean surface, and underwater sound scattering layers, is described. S.C.W.

N67-10386# Joint Publications Research Service, Washington, D. C.

THE FREQUENCY SPECTRUM OF SHORT-PERIOD FLUCTUATIONS OF SEA WATER TEMPERATURE

S. I. Krylov 31 Oct. 1966 10 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 42–45
(JPRS-38405; TT-66-34831) CFSTI: $1.00

An analysis of data on short period water temperature fluctuations in the coastal zone of the Baltic Sea which were obtained in 1963 and 1964 is presented. Although no final conclusions were derived concerning the spectral characteristics of short period temperature fluctuations, the following preliminary conclusions are reported: (1) The presence of short period temperature fluctuations in the active layer of the sea is not a regional phenomenon; (2) One of the principal conditions for the formation of short period temperature fluctuations is the presence of a temperature jump layer; (3) The period of fluctuation is closely related to the value of the temperature gradient and is probably determined by the free oscillations of the jump layer; (4) The period of fluctuation increases with increasing distance from the shore line into the open ocean; and (5) The amplitudes of temperature fluctuations can attain high values in short intervals of time (1.0 to 1.5° in 30 seconds). S.C.W.

N67-10388# Joint Publications Research Service, Washington, D. C.

EXPLORING THE POTENTIAL OF THE OCEAN

O. N. Kiselev 28 Oct. 1966 9 p Transl. into ENGLISH from Sov. Voin (USSR), no. 13 1966 p 30–31
(JPRS-38378; TT-66-34804) CFSTI: $1.00

Recent developments in Soviet hydroaccoustical instrumentation designed to allow freedom of movement during investigations of the ocean's depth are reported. The applicability of these devices in studies of plant and animal life, the extraction of water soluble chemical elements, and the discovery of minerals for industrial use, is discussed. S.C.W.

N67-10395# Joint Publications Research Service, Washington, D. C.

CARTOGRAPHIC REPRESENTATION OF VARIOUS MORPHOLOGIC SPECIES OF LOESS ON LARGE SCALE TOPOGRAPHIC MAPS

Mei-Hsin Chiang and Chia-Chuen Yue 12 Oct. 1966 29 p refs Transl. into ENGLISH from Ts'e Hui Hsueh Pao (Peking) v. 9, no. 1, Feb. 1966 p 44–62
(JPRS-38132; TT-66-34559) CFSTI: $2.00

The distribution and characteristics of loess are discussed. The significance of expressing morphologic species of loess on large scale topographic maps is also presented. The morphologic species of loess are systematically classified and tabulated. The species suitable for cartographic representation in topographic maps are chosen by experiments. Emphasis is given to the characteristics of various morphological species (ravine, valley, plateau, ridge, mao, and plain) and contour maps. The composite principles of cartographic representation and some typical examples illustrating the features of various morphological species are presented. Author

N67-10396# Joint Publications Research Service, Washington, D. C.

THE THEORETICAL FOUNDATIONS OF A METHOD OF MEASURING CURRENT WITH THE EMIT WHILE A SHIP IS TURNING

B. M. Gatsenko 28 Oct. 1966 63 p refs Transl. into ENGLISH from Tr. Dal'nevost. Nauchn.-Issled. Gidrometeorol. Inst. (Leningrad), no. 20, 1965 p 110–141
(JPRS-38383; TT-66-34809) CFSTI: $3.00

A method is described for measuring ocean currents with an electromagnetic induction sweep (EMIT). A theoretical study of the method shows that sharp changes in the total electromagnetic force (emf) of the towed EMIT cable during a ship's turns are connected with changes in the conditions for orienting the cable with respect to the vector for speed. The ship's trajectory in completing a turn in current in the absence of wind drift appears as an elongated cycloid. The emf of the EMIT cable during a ship's turn consists of emf's resulting from the progressive displacement of the cable by the current and its turning by the ship in the earth's magnetic field. A maximum and minimum emf of the EMIT cable are observed on defined magnetic courses for the ship. The amplitude of the emf oscillations changes with latitude inasmuch as it depends on the strength of the earth's magnetic field. It is greater at the magnetic poles and smaller at the magnetic equator. Current direction and speed may be determined from given measurements of the total emf during the ship's turn. Measurement error in the middle latitudes varies from ±9 to ±10%, and is reduced to ±1% by using a neutrally bouyant cable. R.N.A.

N67-10432# Bureau of Mines, Denver, Colo.

STRESSES IN ROCK OUTCROPS NEAR ATLANTA, GA.

Verne E. Hooker and Wilbur I. Duvall 1966
(BM-RI-6860)

The Bureau of Mines conducted a preliminary investigation to determine the state of stress in crystalline rock outcrops near Atlanta, Ga. The secondary principal stresses in a horizontal plane near the surface are compressive and are 500 to 3,000 psi. The maximum compressive stress is northeast-southwest in the Stone Mountain-Lithonia district but changes to northwest-southeast near Douglasville. The elastic constants were determined from data obtained by static and dynamic laboratory methods and in situ velocity measurements. Results show Young's modulus to be dependent upon both stress level and anisotropy in the rock. Average secant moduli obtained from triaxial tests were used to compute the applied stress from borehole deformation measurements. Author

N67-10482# National Research Council of Canada, Ottawa (Ontario).

BASIC MECHANICS OF FREEZING, FROZEN AND THAWING SOILS [OSNOVY MEKHANIKI PROMERZAYUSHCHIKH, MERZLYKH I PROTAIVAYUSHCHIKH GRUNTOV]

N. A. Tsytovich et al 1966 68p refs Transl. into ENGLISH of the publ. "Osnovy Geokriologii Merzlotovedeniya, Chast' Vtoraya, Inzhenernaya Geokriologiya, Glava III" Moscow, Akad. Nauk SSSR, 1959 p 28–79
(NRC-TT-1239; TT-66-62149; AD-638018) CFSTI: HC $3.00/MF $0.75

The mechanics of freezing soils are discussed with respect to change in soil volume, frost heaving, and rejection of water from soil during freezing. The physical properties of freezing soil and ice are reviewed. This is followed by a discussion of the mechanical properties of frozen soil including mechanical bonds, deformation characteristics and compaction under load. The rheological processes in frozen soils are considered in connection with their relation to short-term and long-term loads. The report concludes with a discussion of the stresses and deformation occurring in thawing soils Author (TAB)

N67-10487# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

PLANE PLASTIC DEFORMATION OF SOILS

Shunsuke Takagi Jul. 1966 56 p refs

(CRREL-RR-87; AD-638515) CFSTI: HC $2.00/MF $0.50

A consistent theory of plane plastic deformation of soil is formulated by assuming soil as an ideal material that has constant cohesion and friction angle. Such an ideal soil is an extension of the ideal metal that has, in the terminology of soil mechanics, cohesion only. After a review of the existing theories from which the present theory has emerged, the mathematical expression referred to as the compression characteristic is developed. Then the system of differential equations is shown by the theory of characteristic lines. Many mathematical and physical problems remain to be solved before the perfect explanation of the plasticity of ideal soil will be attained Author (TAB)

N67-10498# Aeronautical Chart and Information Center, St. Louis, Mo.

COMPUTATION METHODS BASED ON MOLODENSKIY'S INTEGRAL EQUATION FOR THE DISTURBING POTENTIAL [METODY VYCHISLENIYA NA OSNOVE INTEGRAL'NOGO URAVNENIYA MOLODENSKOGO DLYA VOZMUSHCHAYUSHCHEGO POTENTSIALA]

V. F. Yeremeyev and M. I. Yurkina Aug. 1966 63p refs Transl. into ENGLISH from Tr. Tsentral. Nauchn.-Issledovatel. Inst. Geodezii Aeros'yemki I Kartografii (Moscow), Issue no. 157, 1965 p 1-46

(ACIC-TC-1092; TT-66-62161; AD-638421) CFSTI: HC $3.00/MF $0.75

Translation of Russian research: computation methods based on Molodenskii's integral equation for the disturbing potential. TAB

N67-10548# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.

THICKNESS OF PERMAFROST BEDS AS AN INDEX OF TECTONIC STRUCTURE OF THE REGION (ON THE EXAMPLE OF THE NORTHERN PART OF WEST SIBERIA)

V. V. Baulin Sep. 1966 12 p refs Transl. into ENGLISH from Geol. i Geofiz., Akad. Nauk SSSR, Sibirsk. Otd. (Novosibirsk), v. 1, 1966 p 53-61

(T-464-R) CFSTI: HC $1.00/MF $0.50

From studies of permafrost under various West Siberian tectonic conditions the author shows that in regions where the basement is at shallow depths the thickness of permafrost beds, other conditions being equal, is always less than in regions where the basement lies at greater depths. The permafrost thickness may show an especially sharp decrease (80-120 m) over anti-clinal uplifts of the higher orders of size. This phenomenon, in the author's opinion, is common to the whole territory of the West Siberian Plain. The author therefore proposes that the distribution of permafrost thicknesses be used for the study of tectonism. Author

N67-10562# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).

IONOSPHERIC DATA OF BANGUI, NOVEMBER 1964 [DONNEES IONOSPHERIQUES DE BANGUI, NOVEMBRE 1964]

[1965] 30 p ref in FRENCH

CFSTI: HC $2.00/MF $0.50

Sounding data are recorded and analyzed monthly by the Bangui ionospheric station. Geographic and geomagnetic coordinates are listed, as well as the logarithmic scale and the duration of the sweep. Terminology and symbols used to describe the ionospheric characteristics are fully explained in accordance with the conventions agreed upon during the International Geophysical Year. Transl. by R.LI.

N67-10563# Groupe de Recherches Ionosphériques, Issy-les-Moulineaux (France).

IONOSPHERIC DATA OF BANGUI, DECEMBER 1964 [DONNEES IONOSPHERIQUES DE BANGUI, DECEMBRE 1964]

[1965] 30 p ref in FRENCH For Abstract see N67-10562 01-13

CFSTI: HC $2.00/MF $0.50

N67-10580# National Observatory of Athens (Greece). Ionospheric Inst.

PROCEEDINGS OF WORKSHOP ON 20 MAY 1966 SOLAR ECLIPSE

Michael Anastassiades Aug. 1966 37 p Conf. held at Athens, 1-5 Jul. 1966

(SR-11A009) CFSTI: HC $2.00/MF $0.50

Summary reports of experiments performed and observations made during the annular solar eclipse in 1966 are presented. Topics covered include solar flux measurements on 2980 Mc/sec at Pentelli hill; riometer observations during the May 20, 1966 solar eclipse on 30.58 and 108 Mc/sec; vertical ionospheric soundings at Scaramanga and Gytheion; oblique sounding during the eclipse; absorption measurements by vertical pulse sounding technique on 1.98 Mc/sec during the eclipse; electron densities of the lower ionosphere by the partial reflection technique; and measurements of electron content by active satellite during the eclipse. L.E.W.

N67-10594# International Geophysical Year World Data Center A, Washington, D. C.

CATALOGUE OF DATA IN WORLD DATA CENTER A—ROCKETS AND SATELLITES, 1 JANUARY-30 JUNE 1966

Aug. 1966 19 p refs

Summaries are presented of sounding rocket, artificial earth satellite, and space probe launching. Miscellaneous observations of satellites by visual, photographic, and radio methods are tabulated, and a subject index of reports and reprints listed by contributing country is also included. A.G.O.

N67-10741*# Pittsburgh Univ., Pa. Space Research Coordination Center.

ROCKET DETERMINATION OF THE DAYTIME SODIUM DISTRIBUTION IN THE UPPER ATMOSPHERE

Robert R. Meier (Ph.D. Thesis) 7 Sep. 1966 112 p refs (Grant NsG-416)

(NASA-CR-79293; SRCC-34) CFSTI: HC $4.00/MF $0.75 CSCL 04A

A rocket photometer was successfully flown on September 26, 1964 to measure the altitude profile of sodium in the daytime. The sodium was discovered to be concentrated in a very narrow layer of only 5 km full width at half maximum density centered at 92.4 km. The peak density was 2.8×10^4 atoms/cm^3. Since this distribution is inconsistent with a photochemical-diffusion theory based on the assumption of a non-local source of sodium, a new model is proposed in which charged, sodium-containing aerosol particles are concentrated into a very narrow layer by means of a wind shear mechanism. Sodium is then liberated through the action of solar radiation. The atoms diffuse away from the source until they are either oxidized by ozone or ionized. This removal must take place in a time which is of the order of the diffusion time in order to produce a narrow sodium distribution. It is quantitatively shown that the proposed model fits the experimental results under somewhat simplified conditions. Author

N67-10794*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE NEAR-EARTH METEOROID ENVIRONMENT

Robert J. Naumann Washington, NASA, Nov. 1966 43 p refs

(NASA-TN-D-3717) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A detailed study of the meteoroid environment has been completed utilizing observational data taken from Explorer XVI, Explorer XXIII, Pegasus I, II, and III, as well as from radar and photographic techniques. These observations cover the entire spectrum of masses important to the meteoroid hazard problem. The consistency of these measurements is examined and a mass distribution function is found which gives a best fit to the measurements. Predictions of penetration frequency are made independently of any mass determination which avoids this source of uncertainty. Author

N67-10928# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

DETERMINING THE VERTICAL GRADIENT OF THE TERRESTRIAL ACCELERATION OF THE REAL EARTH [PRO VYZNACHENNYA VERTIKAL'NOGO GRADIYENTA ZEMNOGO PRYSKORENNYA REAL'NOY ZEMLI]

I. F. Monin Aug. 1966 9p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 1, 1966 p76–79
(ACIC-TC-1083; TT-66-62277; AD-639110) CFSTI: HC $1.00/MF $0.50

New formulas are obtained for the calculation of anomalies of the vertical gradient delta Delta g/delta nu of the real earth Author (TAB)

N67-10951# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.

A SYSTEM FOR MEASURING VECTOR MAGNETIC FIELDS FROM SOUNDING ROCKETS

P. G. Forsyth (Fairchild-Hiller Corp.), and R. O. Hutchinson Aug. 1966 13 p refs *Its* Instrumentation Paper No. 105
(AFCRL-66-565; AD-639327) CFSTI: HC $1.00/MF $0.50

Tests of a newly designed operational system show that the earth's vector magnetic field can be measured from a sounding-rocket nose cone by (a) determining the attitude of a rocket nose cone by means of an electromagnetic attitude-sensor using antenna-array signal-strength patterns; (b) making vector magnetic measurements within the rocket nose cone by means of switched bias coils and a cesium vapor magnetometer; (c) encoding and telemetering the resulting information in a format compatible with the existing facilities; and (d) developing computational techniques for reducing the data obtained from the system Author (TAB)

N67-10981# National Engineering Science Co., McLean, Va.

A BIBLIOGRAPHY ON STORM SURGES AND RELATED SUBJECTS

C. L. Bretschneider and G. S. Pick 1 Aug. 1966 51 p refs
(Contract Nonr-4177(00))
(SN-134-12; AD-639101) CFSTI: HC $3.00/MF $0.50

Bibliography on storm surges and related subjects. TAB

N67-10993# Raytheon Co., Alexandria, Va. Autometric Operation.

MULTIPLE STATION ANALYTICAL TRIANGULATION PROGRAM Final Technical Report

Frederick J. Doyle Dec. 1965 164 p refs
(Contract DA-44-009-AMC-741(X))
(AD-638750) CFSTI: HC $5.00/MF $1.00

The report describes the development and testing of a comprehensive computer program for the simultaneous aerotriangulation of a large block of photographs. The program consists of five principal parts: (1) Comparator observations preprocessor; (2) Photo coordinate correction routine; (3) Aerotriangulation and pass point intersection; (4) Analysis of results; and (5) Error propagation. Part 1 is a separate program to reduce monocomparator or stereo-comparator observations to a format acceptable for computation. Parts 2, 3, 4, and 5 are combined into one efficient program which permits a wide variety of options in the handling of the data. Sufficient tests have been run to demonstrate that the formulation is valid and not restricted by operation at any latitude or longitude on the earth Author (TAB)

N67-10994# Boston Coll., Chestnut Hill, Mass.

EVALUATION OF SEISMIC INSTRUMENTS AND BASIC RESEARCH ON SEISMIC WAVE PROPAGATION Final Report, 1 Sep. 1961–31 May 1966

J. F. Devane, E. G. Bombolakis, J. J. Blaney, T. P. Foley, and J. J. Ginty 30 Jun. 1966 72 p refs
(Contract AF 19(628)-212; ARPA Order 292; Proj. Vela-Uniform)
(AFCRL-66-476; AD-637941) CFSTI: HC $3.00/MF $0.75

A measuring program, using dynamic photoviscoelastic methods, was conducted with the aim of determining the complete rheo-optical characterization of HYSOL (a urethane rubber compound) (AD-616 391). A data analysis center, capable of sophisticated analysis of seismic data was assembled. A preliminary investigation of the time and space-stationary statistical characteristics of seismic noise was made. Three complete seismic instrumentation packages for use in seismic field studies were constructed. Some features of the seismicity and the crustal structure of New England were investigated. Early stages of the brittle shear fracture process were studied in modeled arrays of cracks. Seismic pulses were emitted during each early crack-growth stage, and appreciable increases of applied stress above preceding crack-growth stress were required for further crack growth before crack coalescence could be attained. These results possibly explain some of the microseismic and foreshock activity observed in earthquake phenomena Author (TAB)

N67-11005# Geotechnical Corp., Garland, Tex.

STUDY OF SHORT-PERIOD SEISMIC NOISE Semiannual Technical Summary Report No. 8, 1 Jan.–30 Jun. 1966

E. J. Douze 8 Aug. 1966 32 p refs
(Contract AF 49(638)-1150; Proj. Vela-Uniform)
(TR-66-80; AFOSR-66-1904; AD-638912)

The report describes studies on spectral moments, sources of microseisms, statistical analysis, short-period surface waves, and the Special Orientation Program. (Author) TAB

N67-11027# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

DEFINING THE COLD REGIONS OF THE NORTHERN HEMISPHERE

Roy E. Bates and Michael A. Bilello Jun. 1966 17 p refs
(CRREL-TR-178; AD-639406) CFSTI: HC $1.00/MF $0.50

The boundaries of the cold regions of the Northern Hemisphere are located by using parameters of air temperature, snow depth, ice cover, and frozen ground. Each parameter is discussed in detail and references used to develop four Northern Hemisphere cold regions maps are given. In all mountainous areas where few reporting stations exist, specific elevations or ridge lines were used to locate the limits of certain zones. In some areas, for example Greenland and expansive bodies of water, no isopleths were drawn because the parameter was not applicable or because of insufficient information. It is concluded that nearly all of the land mass north of 40 degrees lies within the cold regions, and that nearly half of the land mass in the Northern Hemisphere can be classified as cold regions Author (TAB)

N67-11054# Alaska Univ., College. Geophysical Inst.

STUDY OF GEOMAGNETIC MICROPULSATIONS Final Report

Charles R. Wilson and John O. Annexstad Aug. 1966 156 p refs
(Contract Nonr-3010(02))
(UAG-R-133; AD-639813) CFSTI: HC $5.00MF $1.00

Over 800 vector diagrams representing the locus of end points of the perturbation vector in three orthogonal planes (H-D, H-Z, D-Z) were constructed from the rapid run magnetograms of

Pg micropulsations observed at College, Alaska and Macquarie Island during 1963 and 1964. The characteristics of Pg's as noted from these vector diagrams are the sense of rotation of the perturbation vector, the shape and orientation of the vector diagrams, and the symmetry relationships between the vector diagrams at conjugate points. The physical characteristics of Pg events observed at conjugate points that were investigated are time and frequency of occurrence, period and amplitude of the components, power spectral density and dispersion of the waves. The vector diagrams of Pg micropulsations are related to the vector diagrams predicted by a model of a rotating ionospheric current induced by standing transverse hydromagnetic waves. The predictions of this model agree with the observed shapes and orientations of the vector diagrams and the sense of rotation of the perturbation vector in the three orthogonal planes of Pg events. The characteristics of the Pg micropulsation as determined in this thesis indicate that Pgs are caused by transverse hydromagnetic waves propagating along the field lines to high latitude conjugate points Author (TAB)

N67-11056# Michigan Univ., Ann Arbor. Inst. of Science and Technology.
COLLECTION AND ANALYSIS OF SEISMIC WAVE PROPAGATION DATA. SUPPLEMENT 2: AN ERROR ANALYSIS OF DIGITAL EQUALIZING FILTERS
John F. Hemdal Aug. 1966 25 p refs
(Contract AF 49(638)-1170; ARPA Order 292-62; ARPA Order 292-65; Proj. Vela Uniform)
(Rept.-5178-64-F2; AD-639435) CFSTI: HC $1.00/MF $0.50

Present day computer systems allow computation of an approximate Wiener operator for the time-domain filtering and smoothing of signals of finite and short length. However, the memory capacity of a particular computer storage introduces a constraint on the length of the operator and signal. To produce the least mean-square-error, it was helpful to know the extent to which the length of the operator should be compromised by including additional information (sample points) of the signal. If N is the number of samples of the signal to be equalized and T is the number of points in the optimum digital operator then the system imposes the constraint that $KN + T(2) < M$ where M is the free capacity of the computer memory and K is the number of multiples of signal length required for the correlations. Tc find out whether an optimum relation between T and N exists, r program to determine the digital operator and to compute the mean-square-error between the filtered result and the desired signal was written for an IBM 7090 computer. The computed errors for some typical seismic signals are presented as a function of operator length, signal length, signal-to-noise ratio, and the number of records used to determine averages. The results suggest that equalization occurs both as a process of signal shaping and of noise reduction, but not necessarily simultaneously. The optimal parameters for optimum equalization depend on the nature of the signal and noise, and may require new determination under novel conditions Author (TAB)

N67-11108# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
TIME DEPENDENT DEFLECTION OF A FLOATING ICE SHEET
Donald E. Nevel Jul. 1966 14 p refs
(CRREL-RR-196; AD-638717) CFSTI: HC $1.00/MF $0.50

A solution for a viscoelastic plate on an elastic foundation is presented for an infinite bulk modulus and a shear modulus which obeys Maxwell's model. Observed deflections of a floating ice sheet agree with this solution. A solution for a viscous shear modulus is also presented. Author (TAB)

N67-11117# High Altitude Observatory, Boulder, Colo.
LISTING OF SUDDEN IONOSPHERIC DISTURBANCES IGY-IGC (JULY 1, 1957– DECEMBER 31, 1959)
J. Virginia Lincoln 10 Oct. 1966 67 p IGY Solar Activity Rept. Ser. 24

Tables present sudden ionospheric disturbances for each day between Jul 1, 1957, through December 31, 1959. Included are particulars of beginning, end, and time of maximum in Universal time, with the station or stations listed for each of the ionospheric effects of solar flares. A widespread index indicates the geographical range of the event, and an importance scale rating is given in each case. The beginning time of a solar flare that can be associated with the event is given, and special note is made of events that are not associated with known flare patrol. M.W.R.

N67-11166# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALBEDO OF THE SNOW-ICE COVER OF THE SEA
A. P. Koptev 15 Jun. 1966 22 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Isled. Inst. (Leningrad), no. 15, 1964 p 25–36
(FTD-HT-66-182; TT-66-62344; AD-639462) CFSTI: HC $1.00/MF $0.50

The article examines albedo of snow and ice with respect to stationary observations on Cape Sterlegov, and also generalizes the results of investigations of the reflecting power of snow-ice layer from aboard an aircraft. Knowledge of these questions is necessary when solving a number of problems in the areas of meteorology, ice flow, and ice forecast Author (TAB)

N67-11198# Arctic Inst. of North America, Montreal (Quebec).
AN ANALYSIS OF LONG SHOT DATA FOR THE CANADIAN SEISMIC STATIONS
Oliver George Jensen May 1966 61 p refs Prepared in Cooperation with British Columbia Univ., Vancouver
(Grant AF-AFOSR-1022-66; ARPA Order 292-65)
(SR-13; RP-37; AD-638752) CFSTI: HC $3.00/MF $0.75

A pilot analysis of the Long Shot nuclear explosion data received by the Canadian seismic stations indicates a consistent compressional first arrival as expected from an impulsive explosion source. Significant travel time discrepancies are observed in the commencement of the P arrival which arrived up to 6 seconds early at all stations with the largest residuals at the most distant sites. A comparison earthquake in the Rat Islands area indicates a similar bias trend. The P arrival amplitudes appear to be anomalously low in the central B.C. area and high in eastern Canada. The effect is also evident in the magnitude determinations which are based on these amplitudes. The causes of the variations of magnitudes and the anomalously low amplitudes have not been explained. The average magnitude and standard deviation for all Canadian stations is shown to be 6.01 plus or minus 0.40 which agrees well with the world wide average determination of 5.99 plus or minus 0.52. Spectral investigations demonstrate that there are both common and individual characteristics among the ground amplitude spectra of the different stations. These characteristics have not been correlated to the explosion source mechanism or to geological structure although some causative suggestions have been made Author (TAB)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N67-10026# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
THE METHOD OF AUTOMATICAL CORRELATION IN CONTACT AUTORADIOGRAPHY

M. Radwan, A. L. Jankowski, and J. Kominek Jul. 1965 31 p refs
(INR-649/XX/I) CFSTI: HC $2.00/MF $0.50

The method of automatical correlation between the micrograph of the structure and its autoradiograph has been developed. The method involves the use of fixing pins in all devices for contact autoradiography. The film carving die, the sample drilling holder and the exposure boxes are described. The method for correlation of pictures on microscope and for making multicolor correlated pictures are given. Author

N67-10035# Royal Aircraft Establishment, Farnborough (England).
THE DRIFT OF AN AUTO-PILOT GYROSCOPE DUE TO PROLONGED ACCELERATION IN THE SKYLARK ROCKET. PART 3: RESULTS FROM SKYLARKS SL29/30
F. R. Knott Apr. 1966 48 p refs
(RAE-TR-66132) CFSTI: HC $2.00/MF $0.50

The attitude of skylark rockets determined from gyroscopes, a radio-interferometer system and a photographic method, is given. Gyro drift obtained by comparing missile attitude from the gyroscopes with attitude derived from interferometer data is also given. Gyro drift rates which occurred during the acceleration period of each rocket flight are then compared with drift rates recorded during ground tests so that in-flight drift rates can be predicted. Author

N67-10040# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-Sous-Bagneux.
TORSION-TEST RIG FOR MICRO-PLASTICITY MEASUREMENTS FROM ROOM TEMPERATURE TO 400°C [MACHINE DE TORSION POUR LES MESURES DE MICROPLASTICITE DE LA TEMPERATURE AMBIANTE JUSQU'A 400°C]
Anatole Popoff and Rene Caze 1966 20 p refs In FRENCH; ENGLISH summary
(ONERA-TN-100) CFSTI: HC $1.00/MF $0.50

The torsion test advantages are recalled and a rig for such tests from room temperature to 400°C is described. There is no secondary stress caused by variations of dimensions of the sample when the temperature changes. Measuring the deformations is carried out by means of mirrors connected to the sample; this is an application of Poggendorff's law. The test-rig detects angular deformations of 1.10^{-6} radian. These deformations are recorded with cameras for accurate readings or by a spot follower. This simple rig is adapted to micro-plasticity measurements and to the evolution of the mechanical characteristics, resulting from temperature variations and/or the application of cyclic stresses. The hot torsion micro-test determines the temperature of the glassy transition of high polymers with a good approximation. A few examples of utilization of this rig are given. Author

N67-10055# Flying Personnel Research Committee, London (England).
A LOW WEIGHT SCINTILLATION COUNTER WITH FOCUSING COLLIMATOR FOR ACCELERATION STUDIES
D. H. Glaister (Roy. Air Force, Farnborough, England) Jan. 1965 16 p refs
(FPRC/Memo-218) CFSTI: HC $1.00/MF $0.50

Redesign of a commercially available scintillation counter resulted in a saving in weight of 25 lbs, while the background count rate rose by only 0.5 cps. No collimator giving sufficiently narrow angle of view for lung function studies was available commercially, so that a multichannel focusing collimator was designed and cast in Wood's metal. The performance of this collimator was investigated and compared to that of simple cone and parallel tube types. When used with radioactive xenon (^{133}Xe) within a phantom lung, 87% of counts come from within a cylinder 2" in diameter. Author

N67-10059# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ON THE DETERIORATION OF PEAKS IN THE SPECTRA OBTAINED WITH THE SINGLE-CHANNEL ANALYZER
Josef Kalisz Mar. 1966 13 p refs
(INR-695/III/PL) CFSTI: HC $1.00/MF $0.50

A mathematical method allowing quantitative determination of the influence of the analyzer channel width on the spectrometer resolution is described. The single-channel analysis is considered with the assumption of Gaussian amplitude distribution at the analyzer input. The channel width may be accurately calculated using the method proposed. The exact graphs and an example illustrating the method are given. Author

N67-10080# Aeronautical Research Labs., Melbourne (Australia).
FURTHER DEVELOPMENT OF A SMOKE PRODUCER USING VAPOURISED OIL
A. E. Hodges and T. N. Pound Nov. 1964 15 p ref
(ARL/A-233) CFSTI: HC $1.00/MF $0.50

A simple device which vaporizes oil to provide a continuous supply of dense smoke for wind tunnel investigations is described, and operating instructions are given. Problems associated with oil condensation, which occurred when previous smoke producers were used with very long connecting smoke tubes, have been minimized by this design which allows higher hot plate temperatures. Author

N67-10085# Joint Publications Research Service, Washington, D. C.
DEVICE FOR MEASURING INTERNAL FRICTION IN THE KILOCYCLE FREQUENCY RANGE
V. I. Razumov and V. S. Postnikov *In its* Internal Friction in Metals and Alloys 4 Oct. 1966 p 14–18 (See N67-10081 01-17)

A device is described for measuring internal friction, elastic modulus, and rate of sound propagation of solids in the frequency range from 6 to 60 kilocycles. The amplitude of oscillation of the specimen can be easily changed and the amplitude function of internal friction can be measured. Temperature range varies from liquid nitrogen temperature to 200°C. Internal friction can be measured with 1% precision; and for large dampings, it can be determined from the width of the resonance curve. Elastic moduli can be measured to within 0.1% from the resonance frequencies of the cylindrical rods with longitudinal or bending oscillations. An electronic recounting device aids in attaining precision measurements. In using the apparatus, it is necessary to account for the marked sensitivity of internal friction to total time due to fatigue effects resulting from specimen excitation. M.W.R.

N67-10236*# National Aeronautics and Space Administration. North Eastern Office, Cambridge, Mass.
LIMITATIONS ON INERTIAL SENSOR TESTING PRODUCED BY TEST PLATFORM VIBRATIONS
Herbert Weinstock Washington, NASA, Nov. 1966 76 p refs
(NASA-TN-D-3683) CFSTI: HC $2.50/MF $0.75 CSCL 17G

Translational and angular vibrations and long-term tilts of test platforms are considered with respect to their limitations on the calibration of precision inertial sensors. For gyroscope testing, the analyses and measurements discussed indicate that the most severe errors will result from angular motions of the platform at frequencies less than 100 cps. For accelerometer testing, the errors in indicated performance are primarily caused by the component of gravity caused, in turn, by rotations of the platform and vibratory accelerations. S.P.

N67-10237*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOGRAPHIC STUDY OF MERCURY DROPLET PARAMETERS INCLUDING EFFECTS OF GRAVITY

Jones I. Sturas, Clifford C. Crabs, and Sol H. Gorland Washington, NASA, Nov. 1966 51 p refs
(NASA-TN-D-3705) CFSTI: HC $2.00/MF $0.50 CSCL 14E

A photographic study was conducted of mercury droplet behavior in gravity environments of 0, 1, 1-1/2, and 2 g's primarily to obtain a simple and reliable method for determining various geometric parameters and shape factors of a sessile mercury droplet in a glass tube. Specific emphasis was placed on those characteristic parameters that would be useful in flow-regime and heat-transfer analyses associated with dropwise condensation of mercury vapor. It is shown that the contact angle of a given size sessile droplet with a solid surface is a function of two dimensionless parameters, size factor and shape factor, which are both dependent on gravity level and are obtained from droplet measurements. Therefore, the method presented herein for determining the contact angle of a sessile droplet is general and applicable to various gravity environments. It is shown that the contact angles calculated from measured droplet dimensions are just as accurate as those obtained by measuring the angles directly from enlarged photographs of a droplet. Empirical equations were developed for expressing the geometric droplet parameters investigated in various environments of gravity. The contact angle increases with an increase in gravity level by a greater amount for large droplets than for small droplets. In a positive gravity environment, the mean contact angle increases with mean diameter of the droplet and approaches a maximum equilibrium value at some fixed droplet size. Author

N67-10363# Bissett-Berman Corp., San Diego, Calif.
DEVELOPMENT OF BUOY-MOUNTED OCEANOGRAPHIC SENSORS (BMOS), PHASE II Progress Report
Neil L. Brown, Jack E. Jaeger, Hugh B. Martin, and Nancy North (Scripps Inst. of Oceanog.) 15 May 1966 92 p
(Contract Nonr-4532(00))
(C104-3; PR-2; AD-637859) CFSTI: HC $3.00/MF $0.75

Detailed descriptions of complete sensors are given along with current results of studies to evaluate transducers, batteries, and anti-fouling techniques. Author (TAB)

N67-10401# Naval Ordnance Lab., White Oak, Md.
NAVAL ORDNANCE LABORATORY WOX-1B PRESSURE RECORDER
Lewis A. Vendetti 29 Jun. 1966 64 p refs
(NOLTR-66-136; AD-638135) CFSTI: HC $3.00/MF $0.75

A description of the Naval Ordnance Laboratory WOX-1B Pressure Recorder is presented. The function of this recorder is to produce solid half wave lobe recordings of bottom pressure fluctuations which are caused by waves and swell Author (TAB)

N67-10415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TELEVISION ARRANGEMENT FOR AUTOMATIC RECOGNITION OF OBJECTS
A. M. Khalfin 28 Jun. 1966 7 p Transl. into ENGLISH from the Russian Patent no. 164627 (Appl. no. 826968/26-24, 21 Mar. 1963) 2 p
(FTD-HT-66-84; AD-639493) CFSTI: HC $1.00/MF $0.50

Television devices for automatic recognition of objects are known, containing an optical system for image projection of the recognized object on a photocathode of an electron-optical image transformer, connected to the recognition block and provided with an image transformer in a digital code, and connected decoding matrices with the transformer. The proposed television device differs from the known ones by the fact, that in the recognition block a face plate is used, consisting of a group of glass fibers, forming the analyzing raster, completed with a photomultiplier, connected to image transformer register triggers, and an additional raster, situated around the analyzing raster. The output of the decoding matrix is connected with the step scanning block of the electron-optical transformer. Such a fulfillment of the device allows the rate of recognizing objects to increase. Author (TAB)

N67-10422# Federal Aviation Agency, Washington, D. C. Aircraft Development Service.
AN EVALUATION OF LOW-COST CARBON MONOXIDE INDICATORS
Gerald R. Slusher Jun. 1966 35 p refs
(ADS-80)

Two types of low-cost carbon monoxide indicators were tested, both in flight and on the ground, to determine their operational performance and suitability for use in general aviation aircraft. The "Detector" reacted in an atmosphere contaminated with engine exhaust gases and provided color warning before exceeding the carbon monoxide exposure time limits for aircraft. A significant retarding effect of humidity was observed on the reaction rate of the "Detector", particularly when it was exposed under low concentrations of carbon monoxide. Continuous exposure of the "Detector" to traces of carbon monoxide (Less than .005 percent by volume), resulted in overexposure and loss of effectiveness in one to five hours time. When the "Detector" was exposed to fresh air, it provided effective monitoring for time periods of up to thirty days. The "NO–CO" Indicator was not sufficiently sensitive for use in general aviation aircraft. Author

N67-10427# Hewlett-Packard Co., Palo Alto, Calif.
HEWLETT-PACKARD JOURNAL, VOLUME 18, NUMBER 1
F. J. Burkhard, ed. Sep. 1966 18 p

The following topics are discussed: (1) *A New Universal Impedance Bridge with Simplified, Semi-Automatic Tuning*—feedback is used to achieve a bridge that requires only one balancing control; (2) *A System for Automatic Control of the DQ Resistor in an Impedance Bridge*—a simplified description and vector diagrams of the automatic tuning process in bridge; (3) *A Plug-In Unit for Extending Counter Type Frequency Measurements to 12.4 GHz*—mixing of unknown high frequency signal with known signal of lower frequency for subsequent readout; (4) *New FCC Rules for FM Stereo Frequency Control;* and (5) *A Frequency Comb Generator with a Range from 1 MHz to beyond 5 GHz*—step recovery diodes for calibration of signal frequency on a spectrum analyzer. G.G.

N67-10428# Hewlett-Packard Co., Palo Alto, Calif.
HEWLETT-PACKARD JOURNAL, VOLUME 18, NUMBER 2
F. J. Burkhard, ed. Oct. 1966 18 p

Discussed are: (1) *An Ultra-Wideband Oscilloscope Based on an Advanced Sampling Device*—solid state sampling plug-ins, remote samplers, pulse generators, and trigger countdown for wideband oscilloscope unit; (2) *A DC to 12.4 GHz Feedthrough Sampler for Oscilloscopes and Other RF Systems*—circuit in the form of ultra-wideband sampling; (3) *A Summary of Some Performance Characteristics of a Large Sample of Cesium-Beam Frequency Standards*—accuracy, intrinsic reproducibility, stability, and reliability of cesium beam standard; and (4) *Operation of the Portable Cesium-Beam Frequency Standard*—block diagram of a portable cesium-beam standard and its utilization in the Omega navigation system. G.G.

N67-10449# National Bureau of Standards, Washington, D. C. Spectrochemical Analysis Section.
SPARK SOURCE MASS SPECTROGRAPH PROGRAM, JULY 1964–JUNE 1966
Paul J. Paulsen and Paul E. Branch 15 Apr. 1966 19 p
(NBS-TN-286) GPO: $0.25

During the report period emphasis was placed on (1) semiquantitative analysis of high purity materials for elements present to the 100 ppb level, (2) obtaining quantitative information on elemental sensitivities and instrument operation by studying samples, and (3) modifying the instrument to improve detection capabilities.

Instrument modifications included additional analyzer pumping, source ion gauge, liquid nitrogen cold finger, and tantalum source parts. The procedure for sample analysis is outlined, and experimental data on isotope ratios and sensitivity factors are tabulated. N.E.N.

N67-10459# Army Electronics Labs., Fort Monmouth, N. J.
PHOTOPOLYMER PRINTER-PROCESSOR (EXPLORATORY DEVELOPMENT)
Pierre Townsend Jun. 1966 19 p
(ECOM-2721; AD-637816) CFSTI: HC $1.00/MF $0.50

An exploratory development model of a Photopolymer Printer–Processor, designed to make positive transparencies from 5-inch-wide aerial roll film by means of the photopolymer process, is evaluated. The equipment is contained in two separate units: a printer, viewer, and chopper in one unit; a processor and dryer in the second unit. The units weigh 80 pounds and 115 pounds, respectively. The light source in the printer is a 100-watt mercury arc tube; about 40 seconds are required for printing. After printing and chopping, the print is manually fed into the processor where it is gripped at the edges by conveyor belts and carried, emulsion side up, down an incline under a stream of 1 percent hydrogen peroxide. Processing and drying require 72 seconds per print. As presently designed, the equipment requires an amount of hydrogen peroxide and water that is excessive Author (TAB)

N67-10532# Argonne National Lab., Ill.
THE DEVELOPMENT AND FABRICATION OF A BORON ABSORPTION TUBE FOR SPECTROGRAPHIC ANALYSIS
J. T. Dusek Mar. 1966 8 p refs
(Contract W-31-109-ENG-38)
(ANL-7164) CFSTI: HC $1.00/MF $0.50

Techniques were developed for fabricating thin-walled B tubes for use as hollow-cathode discharge tubes in spectrographic applications. The most successful specimens made contained 10 wt% of W. Data are presented on composition of the B specimens and the high-temperature interactions that occurred during specimen sintering. Author (NSA)

N67-10573# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Aeronautical Engineering.
SMOKE GENERATOR TYPE LORINDER FOR FLOW VISUALIZATION IN LOW SPEED WIND TUNNELS
Lars D. Sellberg Jun. 1966 14 p refs
(KTH-AERO-TN-55) CFSTI: HC $1.00/MF $0.50

The smoke generator has been successfully used for flow visualization in low speed wind tunnels up to 60 meters per second (200 feet per second). The smoke can be injected into the airstream of a closed return-circuit tunnel for a considerable time without noticeable degradation of contrast. A brief description of the smoke generator is given, relating operational wind tunnel experience with this equipment. Comments are given on the safety aspects of its use. Author

N67-10625# California Univ., Berkeley. Coll. of Engineering.
FRICTION IN ULTRAHIGH VACUUM. PRELIMINARY TESTS ON ALUMINUM SURFACES
J. Frisch, R. D. Nelson, and P. Pfaelzer Apr. 1966 17 p refs
(Contract W-7405-ENG-48)
(MD-66-2; UCRL-13212) CFSTI: HC $1.00/MF $0.50

Three preliminary friction tests on aluminum specimens were conducted in the ultrahigh vacuum chamber to check the operational performance of equipment and instrumentation. These tests demonstrated the suitability and capability of the equipment. The calibration and addition of a more efficient strain gauge dynamometer in the vacuum chamber as well as some changes in test procedure were suggested by these tests. NSA

N67-10662# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY AND CONSTRUCTION OF A MULTICHANNEL BETA SPECTROMETER WITH UNIFORM MAGNETIC FIELD [ETUDE ET REALISATION D'UN SPECTROMETRE BETA MULTIVOIES A CHAMP MAGNETIQUE UNIFORME]
Francois Schussler (Ph.D. Thesis—Grenoble Univ.) 1966 55 p refs In FRENCH
(CEA-R-2950)

After a brief survey of the interest of a multichannel beta spectrometer for studying decay schemes of short lived nuclides (30 seconds minimum), the theoretically well known characteristics of uniform magnetic field analyzer, image of a large source, and transmission and resolution are briefly discussed. The apparatus built as a result of these calculations is described. This apparatus allows the determination of beta spectra by simultaneous determination of the beta spectra in coincidence with four gamma rays predetermined in the gamma spectrum of the studied nuclide. Finally, the experimental characteristics of the spectrometer calibration in energy and transmission and the first measurement of beta spectra (^{155}Sm) and of coincidences (^{24}Na), are given. Author (NSA)

N67-10722# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
INVESTIGATION OF PARAMETERS OF TWO TYPES OF SPECTROMETER STABILIZATION SYSTEMS [ISSLEDOVANIE PARAMETROV DVUKH TIPOV SISTEM STABILIZATSII SPEKTROMETROV]
V. I. Prikhod'ko and V. G. Tishin 20 Apr. 1966 19 p refs In RUSSIAN
(JINR-P-2707)

Two types of spectrometer stabilization systems which are used for precise measurements of pulse-height spectra are considered. The effect of the parameters of such systems on the basic spectrometer characteristics (rate of setting equilibrium with changes in threshold or gain, broadening of the peaks in the spectrum, and shifts in the peaks as a function of linearly changing drifts) is estimated. Results are presented of the experimental investigation of the two types of stabilization systems. Author (NSA)

N67-10749*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN AND USE OF DISPLACEMENT GAGE FOR CRACK-EXTENSION MEASUREMENTS
Douglas M. Fisher, Raymond T. Bubsey, and John E. Srawley Washington, NASA, Nov. 1966 15 p refs
(NASA-TN-D-3724) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A double-cantilever displacement gage was designed for use in plane-strain crack-toughness tests of through-cracked plate specimens. The gage magnification was approximately 750, with 10-volt strain-gage bridge excitation and bridge output recorded on a 0.5-millivolt-per-inch scale. The linearity of the gage was within 0.0001 inch over a range of 0.200 to 0.250 inch. The design considerations necessary for the determination of the mechanical features, the strain-gage circuit, and the registry aspects of the gage are presented. With suitable strain gages, the instrument can be used at cryogenic temperatures. Load-displacement slopes were determined for a range of crack lengths in bend specimens. The ratio of major span to specimen width was 4, and results were obtained for both three- and four-point loading with special fixtures designed to minimize friction effects. The results show the relation between displacement per unit bending moment and crack length in dimensionless form. Author

N67-10763# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
METHODS OF STEREOSCOPIC CAMERA ADJUSTMENT [METODIKA YUSTIROVKI STEREOFOTOAPPARTOV]

E. M. Andreev, G. Libman, and G. I. Selivanov 29 Apr. 1966 12 p refs In RUSSIAN Submitted for Publication (JINR-P-2727)

The procedure of stereoscopic camera adjustment for a bubble chamber is described. The criteria are given which determine the constructive elements of some arrangements as well as the ways of eliminating errors which are due to the inaccuracy in the manufacturing of the mechanical assemblies. Author (NSA)

N67-10792*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A METHOD FOR THE MEASUREMENT OF EXTREMELY FEEBLE TORQUES ON MASSIVE BODIES
J. C. Boyle and J. M. Greyerbiehl Washington, NASA, Nov. 1966 21 p refs
(NASA-TN-D-3711) CFSTI: HC $1.00/MF $0.50 CSCL 14B

A method has been developed for measuring torques generated by interaction between the magnetic dipole of a spacecraft and the ambient magnetic field. This report describes two torquemeters that have been developed and their calibration and performance tests. Also included is a discussion of the applicability of this method to the evaluation of attitude control systems that use magnetic torquing, as well as a number of other potential uses. There also appears a description of the successful use of one of these torquemeters in the evaluation of the spin control systems of the DME-A and AE-B spacecraft, which are scientific satellites of the Explorer series. Author

N67-10821# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Soyuznyi Nauchno-Issledovatel'skii Institut Priborostroeniya.
CALIBRATION OF THERMAL-NEUTRON RADIATION METERS IN DIFFUSE FLOW [GRADUIROVKA RADIOMETROV TEPLOVYKH NEITRONOV V DIFFUZNOM POTOKE]
R. D. Vasil'ev, G. A. Dorofeev, V. I. Petrov, M. I. Pimenov, and V. F. Shevchenko 1966 6 p refs In RUSSIAN
(Rept.-7; NP-16201)

The sources of thermal neutrons needed for neutron radiometer calibration should have a negligible background of γ radiation, offer a near-Maxwellian distribution of thermal neutrons, and allow a rapid change in neutron intensity. None of the existing sources satisfy all of the above requirements. Consequently, a new thermal neutron source consisting of a graphite moderator with a cavity containing a T(d,n)^{4}He source of fast neutrons driven by a low-voltage cascade accelerator yielding 5.10^9 neutr/sec was designed. The device operated satisfctorily and yielded $\sim 10^8$ n/sec cm^2 beams with a Maxwellian velocity distribution corresponding to 293°K. A comparison with directed beam calibration shows that the new source producing diffuse fluxes yields somewhat lower calibration values. However, this should be considered an advantage since the calibrated radiometers are, as a rule, used under diffuse neutron flux conditions. NSA

N67-10857# Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Fisica Nuclear.
ABSOLUTE MEASUREMENTS OF THE ACTIVITY OF RADIONUCLIDES. I: THE DEFINED SOLID-ANGLE METHOD WITH GEIGER-MUELLER COUNTERS
Dagmar C. C. Reis and Lais P. de Moura Dec. 1965 32 p refs (IEA-115)

A detailed account of the defined solid angle method with Geiger-Müller counters is presented. A system is described in which both the geometry and dead time are defined independently of the counter and the influence of the different factors which affect the overall efficiency is analyzed. Because of its reliability and simplicity the method is largely used for routine measurements, in spite of its limited precision. Author (NSA)

N67-10899*# Barnes Engineering Co., Stamford, Conn.
NASA PHOTOMETER Final Progress Report
10 Jul. 1966 46 p refs
(Contract NAS5-10164)
(NASA-CR-79702; BEC-3775) CFSTI: HC $2.00/MF $0.50 CSCL 20F

The design features of the laboratory photometer to accept interchangeable photomultipliers and related changes in electronics and display units are summarized, and the test results are discussed. The proposed approach incorporates the photomultiplier detector operated in a constant current mode wherein the multiplier dynode voltage impressed upon the detector and the gain is controlled to achieve a constant anode current. The modifications are described, and a spectrally calibrated source of irradiance is provided. Measurement of spectral transmittance of the optics was accomplished, and it was concluded that the photometer meets the essential requirements of the procurement specification. N.E.N.

N67-10949# Naval Civil Engineering Lab., Port Hueneme, Calif.
A 7.5-KVA POWER TRANSIENT SYNTHESIZER Technical Report, Jul. 1965–Jun. 1966
H. H. Kajihara Aug. 1966 28 p
(R-473; AD-637826) CFSTI: HC $2.00/MF $0.50

The report describes a newly developed, electrical-power test unit designated a power transient synthesizer. The synthesizer is essentially a power source which furnishes line-frequency, alternating-current, electrical power, containing a variety of power parameter fluctuations. The power parameter deviations last from 8.3 milliseconds to 5 seconds and include fundamental frequency overvoltages and undervoltages, momentary power outages, pulse voltages of 10 to 4,000 volts superimposed on the fundamental sine waveform, and frequency deviations of 0.2 cps to 6 cps about the fundamental frequency. Test data taken on a DC power supply is presented to illustrate the capabilities of the synthesizer Author (TAB)

N67-10964# Army Biological Labs., Fort Detrick, Md.
INVESTIGATION OF BIOPOLYMERS WITH THE HELP OF A NEW HIGHLY SENSITIVE PHOTOELECTRIC SPECTROPOLARIMETER
V. G. Alekseyev, M. A. Mokulskiy, and V. I. Kurchatova Aug. 1965 6 p refs Transl. into ENGLISH from Biofizika (Moscow), v. 10, no. 2, 1965 p 347–349 *Its* Transl. No. 1603
(TT-66-62179; AD-638589) CFSTI: HC $1.00/MF $0.50

A description is given of a highly sensitive, photoelectric spectropolarimeter, intended for measuring the dispersion of optical activity in the area from 400 up to 700 millimicrons. As an extended operation test showed, this spectropolarimeter makes it possible to conduct measurements with microquantities of optically active substances, which is especially important for biological, chemical and physico-chemical investigations. TAB

N67-10973# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR MEASURING THE TEMPERATURE OF THE OVERHEATING OF THE REVOLVING PARTS OF MACHINES
V. K. Mochalov 28 Jun. 1966 5 p Transl. into ENGLISH from the Russian Patent no. 168916 (Appl. no. 890922/26-10, 20 Mar. 1964) 2 p
(FTD-TT-65-1939; AD-639152) CFSTI: HC $1.00/MF $0.50

In measuring the temperature of overheating of the revolving parts of machines, for example, the disk armatures of electrical machines, with the aid of photoelectric pyrometers, it is impossible to keep out error connected with the turning of the part. The proposed device makes it possible to decrease this error. It contains an ordinary photoelectric pyrometer with a revolving cut-off and is distinguished from the known devices for the same purpose by the fact that, for improving the precision of the measurement by

means of a stroboscope effect, the cut-off is provided with a drive which assures its turning synchronously with the revolving part. Author (TAB)

N67-10983# Army Materials Research Agency, Watertown, Mass.
A REPORT GUIDE TO ULTRASONIC TESTING LITERATURE. VOLUME II: MONOGRAPH SERIES
Ernest N. Rodgers and Charles P. Merhib Jun. 1966 121 p refs
(AMRA-MS-66-05; AD-638749) CFSTI: HC $4.00/MF $0.75

The main objective of this compilation is to provide a simple and fast access to information on the subject of ultrasonic testing and also to provide sufficient information in the form of abstracts and word descriptors to make the listing useful. TAB

N67-10985# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A HIGH INTENSITY SHORT DURATION PHOTOGRAPHIC LIGHT SOURCE FOR USE AT LOW AMBIENT PRESSURE
Jack S. Williams Jun. 1966 19 p ref
(BRL-TN-1618; AD-639297) CFSTI: HC $1.00/MF $0.50

The report describes an enclosed spark gap light source designed to be operated in a low pressure environment. While the light intensity from an open spark gap is greatly reduced at lower ambient pressures, the enclosed spark gap system maintains a constant light intensity through a range of ambient pressures from 760 millimeters to 100 microns of Hg. In addition, other electrical problems that occur at reduced pressures are eliminated Author (TAB)

N67-11003# System Development Corp., Santa Monica, Calif.
STUDY OF TWO IMAGE INTERPRETER MAP DISPLAYS: CHIP VERSUS HARD COPY
Richard S. Laymon Washington, Army Personnel Res. Office, May 1966 37 p
(Contract DA-49-092-ARO-65)
(AD-639126) CFSTI: HC $2.00/MF $0.50

Comparison was made of two methods of displaying reference maps for the use of image interpreters in a tactical image interpretation facility (TIIF). Image interpreters were required to perform two tasks -- to match imagery to a reference map and then to estimate the coordinates of a point on the image. Time taken to reach correct solutions was compared when reference maps were displayed from simulated slide chips (map sections projected onto a fixed screen) and when hard-copy map chips (standard presentation) were used. Measures of performance with both display modes were obtained under experimental conditions where the image would appear on one or two chips. Two conditions of imagery orientation for each map display mode were also imposed: one in which position of the imagery was fixed and one in which the imagery could be freely oriented to the map display. Separate analyses of variance were conducted on time scores from the matching and locating tasks. The following major conclusions were derived: (1) Display of map information upon a screen instead of by hard copy increased time taken by an interpreter to match imagery and to determine map coordinates of an object on an image; the longer time required when the interpreters used map chips was attributable to need to study two slides when the imaged area lay on the boundary of one or both chips. (2) Freedom to orient an image relative to a map display did not affect time taken to complete either the matching or the locating task Author (TAB)

N67-11048# General Electric Co., Syracuse, N. Y. Heavy Military Electronics Dept.
THIN FILM SENSITIVITY INVESTIGATION Technical Report, Mar. 1964–Apr. 1965
J. Gaynor, S. Aftergut, and R. Kopczewski Griffiss AFB., N. Y., RADC Jul. 1966 68 p refs
(Contract AF 30(602)-3668)
(RADC-TR-66-361; AD-638893) CFSTI: HC $3.00/MF $0.75

A multilayer medium for electroionic electrophotography was developed. A doped cadmium sulfoselenide photoconductor film was in electrical contact with a development layer through an anisotropically conducting separator (multilead glass). The separator protected the photoconductor from contamination by reagents in the development layer. A semitransparent gold layer and aluminum foil served as electrodes. A 20 millisec exposure simultaneous with the application of an electric field produced the image as an electrolytic deposit in the development layer without need for subsequent processing. The image is viewed after parting the layers Author (TAB)

N67-11061# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH SPEED PHOTOGRAPHY
Tai-Hua Chan 11 Aug. 1966 9 p Transl. into ENGLISH from K'o Hsueh Hua Pao (Communist China), no. 2, 1964 p 46–48
(FTD-TT-65-724; TT-66-62341; AD-639443) CFSTI: HC $1.00/MF $0.50

Translation of Chinese research: high speed photography. Author (TAB)

N67-11062# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPULSE MASS SPECTROMETER FOR STUDYING HIGH-VELOCITY PHENOMENA IN LOW-PRESSURE GASES AND NONSTATIONARY PLASMA
V. A. Simonov and A. G. Mileshkin 15 Jun. 1966 19 p refs Transl. into ENGLISH from Cesk. Casopis Fys. (Prague), v. 12, no. 5–6, 1962 p 653–665
(FTD-TT-65-859; TT-66-62336; AD-639423) CFSTI: HC $1.00/MF $0.50

Impulse spectrometry methods effectively facilitate the study of high-velocity phenomena in various fields of scientific research - in electronics, plasma physics, chemical kinetics, and vacuum technology. Equipment was developed which permits analysis of phenomena in neutral gas as well as in plasma over a wide range of pressures, plasma concentration, and life spans of the effects studied Author (TAB)

N67-11067# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INVESTIGATION OF THE PULKOVO POLARIMETER AND ASI-4 CHAMBER
Ye. K. Kokhan 6 Jun. 1966 20 p refs Transl. into ENGLISH from Izv. Glavnoi Astron. Observ. (Pulkovo), v. 23, no. 5, 1964 p 86–92
(FTD-TT-65-1095; TT-66-62347; AD-639485) CFSTI: HC $1.00/MF $0.50

In order to increase the precision of measurements of polarized light improvements were made in the design of the electropolarimeter based on V. I. Myuhkyuryas system. The amplification coefficient of the amplifier and the current and voltage sensitivities of the electropolarimeter were determined. The light sensitivity of the electropolarimeter, spectral characteristic of the ASI-4 camera, spectral response of the electropolarimeter and spectral characteristic of the polaroid were investigated. The errors of measurements of polarization due to the electropolarimeter and the ASI-4 camera were computed Author (TAB)

N67-11119# Tellurometer, Inc., Washington, D. C.
MICRO-DISTANCER, MODEL MRA3 MkII AND MkIII
Oct. 1963 10 p

Principles of operation and mechanical and electrical details are given for a self-contained electronic distance-measuring

instrument, a microwave tellurometer. Integral parts of the instrument are an antenna system, a power unit, and a battery that permits approximately two hours continuous operation. Except for its klystron, the instrument is an all-transistor unit; although the battery can be replaced by an external 12-volt dc source or converter unit. The tellurometer is available with either a numerical display or a radial-line display on a cathode ray tube, and the two models are interchangeable. Measuring capability is considered in excess of 80 km; and, under favorable conditions and subject to zero-error calibration, overall measuring error is considered to be no more than ± 1 cm in ± 3 parts/10^6 of the length being measured. M.W.R.

N67-11137# Wilcox Electric Co., Inc., Kansas City, Mo.
DEVELOPMENT OF LINEAR GLIDE SLOPE FIELD DETECTOR FOR USE WITH CATEGORY I, II, AND III LANDING SYSTEM MONITORS Final Report
Brandon Reed Apr. 1966 18 p
(Contract FA-65-WA-1274)
(SRDS-RD-66-12)

The objective was to design and produce six linear glide slope field detectors for use with Category I, II, and III Landing System Monitors. To assure optimum reliability and stability of the field detector, the most advanced techniques were employed. The field detector consists of an antenna and mounting assembly and a detachable detector unit that can be used with any 50-ohm rf source of the correct magnitude and frequency. Design characteristics of the field detector permit compatible operation with the following landing system monitors: Wilcox CA-1363, Wilcox FA-5479X, and Litton CA-5010. Author

N67-11147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR MULTIPLE-POINT MEASUREMENT OF TEMPERATURE
S. P. Mazur 28 Jun. 1966 6 p Transl. into ENGLISH from Russian Patent no. 168497 (Appl. no. 868924/26-10, 4 Dec. 1963) 2 p
(FTD-TT-65-1937; AD-638872) CFSTI: HC $1.00/MF $0.50

The object of the invention is a device for multiple-point measurement of temperature with the aid of a thermocouple included in the circuit of a potentiometer with a change-over switch. Thermocouples are connected to a potentiometer through a junction box in accordance with the scheme: thermocouple–junction box–change-over switch of the potentiometer–slip rings of the change-over switch-junction box–terminal of the potentiometer, while the compensation wire is extended only on the first and last sections. Author (TAB)

N67-11149# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANEMOMETER FOR MEASURING LOW RATES OF GAS FLOW
G. G. Belov 28 Jun. 1966 6 p Transl. into ENGLISH from Russian Patent no. 168949 (Appl. no. 891020/26-10, 26 Mar. 1964) 2 p
(FTD-TT-65-1940; AD-639157) CFSTI: HC $1.00/MF $0.50

The anemometer contains a wind wheel, together with a contactless (for example, photoelectric) system of registering rates of flow. For improving the sensitivity of the anemometer, and also assuring the continuity and stability of the measurements, the anemometer is provided with an electric motor, with a system of permanent magnets located on its shaft, with a metallic disk located in the field of these magnets and fastened on the axis of the wind wheel. Author (TAB)

N67-11150# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF ATTACHING WIRE TRANSDUCERS UNDER HYDROSTATIC PRESSURE
Yu. D. Mazur-Dzhurilovskiy 28 Jun. 1966 5 p Transl. into ENGLISH from Russian Patent no. 169160 (Appl. no. 743039/23, 29 Aug. 1961) 1 p
(FTD-TT-65-1941; AD-638886) CFSTI: HC $1.00/MF $0.50

The object of the invention is a method of attaching wire transducers under hydrostatic pressure by polymerized glues. The part with the strain gage to be glued on is first placed in a rubber envelope filled with loose material and then in a chamber with high pressure. TAB

N67-11160# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AMPLITUDE-PHASE MEASURING DEVICE WITHOUT PHASE SENSITIVE DETECTORS
Yu. B. Shaub 31 Aug. 1966 12 p Transl. into ENGLISH from Nauchno-tekhn. Inform., Geofizicheskoye Priborostr. (Leningrad), no. 16, 1963 p 38–45
(FTD-TT-66-9; TT-66-62248; AD-638977) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: amplitude phase measuring device without phase sensitive detectors. TAB

N67-11162# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING MAXIMUM VALUES OF GRAVITATIONAL DRIFT FROM UNEQUAL RIGIDITY OF FLOATING INTEGRATION GYROSCOPES
G. A. Slomyanskiy 31 Aug. 1966 15 p refs Transl. into ENGLISH from Tr. Aviats. Tekhnologicheskiy Inst. (Moscow), no. 59, 1964 p 74–82
(FTD-TT-66-63; TT-66-62241; AD-638902) CFSTI: HC $1.00/MF $0.50

Translation of Russian article: determining maximum values of gravitational drift and drift from unequal rigidity of floating integration gyroscopes. TAB

N67-11163# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE USE OF A HIGH FREQUENCY FILM CAMERA TO STUDY PLASTIC DEFORMATION OF METALS AT EXPLOSIVE BURDENS
A. Schweighofer 28 Jun. 1966 9 p refs Transl. into ENGLISH from Temna Mechanika a Optika (Czechoslovakia), no. 3, 1965 p 75–76
(FTD-HT-66-43; TT-66-62225; AD-638873) CFSTI: HC $1.00/MF $0.50

A method is described of using the Czech high frequency film camera for the purpose of registering the process of explosive deformation of metals. The main attention is devoted to the method of illuminating the filmed action and synchronization of the formin process with the effectiveness of the high frequency chamber Author (TAB)

N67-11193# Army Intelligence Center, Fort Holabird, Md.
DIAPOSITIVE FORMAT FOR ORIGINAL FILM RECORD IN AERIAL SURVEILLANCE Jul. 1966 147 p refs
(USACDCINTA-65-6; AD-638017) CFSTI: HC $4.00/MF $1.00

A study was made of the feasibility and desirability of converting from negative processing of aerial photographic imagery used in intelligence production to a system of processing which would provide a diapositive (positive transparency). The technique is considered feasible. A cost/effectiveness analysis showed that diapositives are consistently superior to negatives in accuracy and completeness. The impact of conversion was analyzed for several types of processes and doctrine was developed to allow the Army to take advantage of the potentially superior effectiveness of diapositives Author (TAB)

N67-11200# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GROUND REFLECTION PROBLEMS IN TELLUROMETER MEASUREMENTS
Sha Tzi-chung and La Sih-an 31 May 1966 41 p refs Transl. into ENGLISH from Ts'e Hui Hsueh Pao (Communist China), v. 7, no. 3, 1964 p 155–176
(FTD-TT-65-900; TT-66-62151; AD-638173) CFSTI: HC $2.00/MF $0.50

Based on the electronic principle of the tellurometer, a general formula for the phase deviation caused by ground reflection is derived in this paper and the reasons for the measurement errors and figure distortions explained. Combining actual experience and experimental results, the relationship between the distance difference in the surveying line, the reflection coefficient, the reflection area and ground reflection was analyzed. From this analysis, a principle in selecting the surveying line for plateaus and hilly areas was proposed. In studying the methods for minimizing the influence of ground reflection, the techniques of lowering the height of the instrument and the insertion of a metallic net-like shield were thoroughly discussed. Experimental results were cited. Based on theory and actual results, the influence of ground reflection could be greatly reduced by a judicious choice of a surveying line in combination with suitable techniques. Also investigated was the method of correcting the ground reflection curve of flat lands. The method was shown to have a definite practical significance in distance measurements where a higher accuracy is demanded and the distance difference and the reflection coefficient can easily be obtained (e.g., the determination of the zero point). A few actual examples and some tables are given as convenient references for practical work. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N67-10016# Laboratorio de Acustica e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF 8182 CYLINDERS OF KRS HIGH PRESSURE PUMP, PART 1 [INSPECAO ULTRA-SONICA DE PECA 8182 DA BOMBA TIPO KRS, PECA NO. 1]
L. X. Nepomuceno and M. F. Barbosa 29 Jul. 1966 16 p refs In PORTUGUESE; ENGLISH summary
(Rept.-6607.258/256) CFSTI: HC $1.00/MF $0.50

To determine flaws and other defects in cast iron pump components, ultrasonic testing was conducted on a hydraulic pump. The test method adopted, equipment, and accessories used in the inspection are described. Photographs depict the part inspected tested, which is the one usually defective, and also the results of echo soundings, in the form of reflectograms. It was concluded that the particular part tested was free from defects. Transl. by R.U.

N67-10281# Naval Ordnance Lab., White Oak, Md.
METAL DIAPHRAGM RELEASED EXPLOSIVELY
Rayner A. Montgomery and John H. Abell 25 Apr. 1966 19 p refs *Its* Ballistic Res. Rept.-162
(NOLTR-66-77; AD-638180) CFSTI: HC $1.00/MF $0.50

A repeatable method of opening a metal diaphragm has been developed for use where timing is an important factor. The opening is initiated by an explosive cemented in the grooves of an 8-inch by 8-inch diaphragm. This technique, used in the NO' Shock Interaction Facility, produces a timing event repeatable within plus or minus 1 percent Author (TAB)

N67-10306# National Beryllia Corp., Haskell, N. J.
FABRICATION OF BERYLLIUM OXIDE RADOMES BY PYROLYTIC DEPOSITION Final Engineering Report, 28 May 1964–1 Jun. 1965
W. A. Taebel and G. Hoekstra 1 Jun. 1965 45 p
(Contract NOw-64-0512-f)
(AD-638219) CFSTI: HC $3.00/MF $0.50

An investigation was made of three forms of beryllium oxide, monolithic beryllia ceramic, foam structures, and structures reinforced with beryllia fibers. The pyrolytic method was investigated as a means of preparing dense beryllia and fibers of the oxide. Specifically, a chemical vapor deposition process involving a reaction between a halide of beryllium and water (hydro-pyrolytic reaction) and the pyrolysis of an organic adduct of beryllium were studied as means of preparing continuous deposits of beryllia. The vapor phase oxidation of beryllium metal was also investigated as a process for preparing beryllia fibers or whiskers. Deposits of limited thickness were prepared by the hydropyrolytic reactions involving oxygen donor systems such as either water or nitrogen dioxide. For either system, evidence points toward the fairly rapid attainment of equilibrium conditions wherein the deposit of beryllia produced by the reactions is eroded by the volatile non-metallic oxides of the reactants or products of the reactions. Preliminary results indicated that adherent, dense, and hard deposits of conceivably unlimited thickness could be prepared by the pyrolysis of a volatile organic adduct of beryllium. Sporadic success was attained in growing beryllia fibers by the vapor phase oxidation of beryllium metal. (TAB)

N67-10328# Rock Island Arsenal Lab., Ill. Research and Engineering Div.
A STUDY OF THE ROOM TEMPERATURE PHOSPHATE PROCESS
Jodie Doss Jun. 1966 21 p refs
(RIA-66-1858; AD-637961) CFSTI: HC $2.00/MF $0.50

Attempts were made to establish optimum concentration of constituents and operating conditions for the room temperature zinc phosphating process and to attempt to convert the conventional manganese phosphate solution into a room temperature phosphate solution. For the room temperature zinc phosphate process the optimum pH was found to be approximately 4. Good coatings were produced from solutions that were two to three times more concentrated in total acid than the normal operated solution. Moderate addition of nitrite to the room temperature phosphate solution decreased the coating weight of the resultant coating but not the corrosion resistance. A large amount of nitrite decreased the ferrous iron and zinc content. Attempts to convert a conventional manganese phosphate solution into a room temperature phosphating solution was not successful at this time Author (TAB)

N67-10347# Rutgers Univ., New Brunswick, N.J. School of Ceramics.
EVALUATION OF THE FUSION CASTING PROCESS FOR CERAMIC MATERIALS Final Report
William H. Bauer, Richard G. La Bar, Robert W. Matolka, and David R. Reid 6 Jun. 1966 163 p refs
(Contract NOw-65-0294-d)
(AD-638649) CFSTI: HC $5.00/MF $1.00

Using Al2O3 as the study material, an investigation of the fusion casting process was made. Furnaces and molds suitable for experimental casting are described. A mathematical treatment and some experimental results on heat extraction are given. The effects of minor chemical additions and vibrational casting on macro- and microstructure are shown. A technique for measuring damping capacity was developed which provided an evaluation of castings and reasons for unsoundness of castings. (Author) TAB

N67-10414# Boeing Co., Seattle, Wash. Nuclear Metals, Inc., West Concord, Mass.
SEMI-CONTINUOUS PRESSURE SINTERING Summary Report, 3 May 1965–29 Apr. 1966
Roy W. Rice and James G. Hunt May 1966 67 p refs
Prepared jointly with Nucl. Metals, Inc.
(Contract NOw-65-0382-c)
(AD-638453) CFSTI: HC $3.00/MF $0.75

A process of semi-continuous pressure sintering was proposed wherein a ceramic powder was to be encapsulated in a suitable metal tube and subsequently densified by combinations of rolling, swaging and drawing at various temperatures. Requirements for development of the process were established and essentially met. No adaptation of facilities was found necessary for room temperature rolling or for swaging at temperatures of at least 1100C. Hot drawing facilities were readily adapted using ZrO2 dies shrunk into TZM holders. Stainless steel tubes were found to have adequate chemical compatibility with both the process parameters and the MgO. These tubes were also found to be generally mechanically compatible with the ceramic and process parameters for all operations except hot drawing. However, hot swaging which was readily accomplished, appears to do the job expected of hot drawing. Fine, active MgO powders showed good compaction, achieving as much as 90% of theoretical density at room temperature; good sinterability, particularly with LiF which allows densification at least as low as 700C; and some creep plasticity especially with LiF during final densification that helped cope with tube elongation. Best results were obtained with MgO + LiF. Swaging at progressively increasing temperatures to 750C, firing at 1000C (in the sealed tube) resulted in essentially crack and inclusion free sections up to 98% of theoretical density. Further firing of the MgO in air to 1200C resulted in translucency (over 99% of theoretical density). Author (TAB)

N67-10418# Army Materials Research Agency, Watertown, Mass. Materials Technology Div.
SOURCES AND CAUSES OF POROSITY IN TITANIUM ARC WELDS
Mark M. D'Andrea, Jr. Mar. 1966 26 p refs
(AMRA-TR-66-06; AD-638169) CFSTI: HC $1.00/MF $0.50

An exploratory study was conducted in which theoretical concepts were investigated and established to account for the phenomena of porosity formation in titanium arc welds. Significant and nonsignificant sources of gas evolution and the probable causative gases were determined. The work was limited to a study of the effects of seemingly pertinent material and welding parameters pertaining to single-pass, open-air, inert-gas-shielded consumable electrode (MIG) welding procedures in 1/8-inch-thick Ti-6Al-4V sheet material. The results of the study were deemed applicable in general for arc welds made in titanium plate and other titanium base materials. The important conclusion was that individually molecular hydrogen and oxygen were considered to be definite, independent, causative gases. The following gases were considered not causative: H2O, N2, NsubxOsuby compounds, CO, CO2, A, He, S and P plus their oxides, and CsubxHsuby and CsubxHsubyOsubz compounds. Sources of hydrogen porosity were considered hydrogen-bearing foreign matter on and entrapped in the surface of base material, and hydrogen contained in the base material essentially in the form of titanium hydride. The source of oxygen porosity was considered to be oxygen-bearing scale on the surface of base material. The qualitative and somewhat quantitative aspects of sources and causes as well as the mechanisms of gas evolution and entrapment are presented herein. Author (TAB)

N67-10542# Metaalinstituut TNO, Delft (Netherlands).
DEVELOPMENT OF SELECTION METHODS AND REFERENCE PROCEDURES FOR AN ALKALI-FREE STEAM CLEANING AGENT AND AN ALKALINE LACQUER AND GREASE REMOVING AGENT [DE ONTWIKKELING VAN KEURINGSMETHODEN EN REFERENTIERECEPTUUR VOOR EEN ALKALIVRIJ STOOMREINIGINGSMIDDEL EN EEN ALKALISCH ONTLAK- EN ONTVETTINGSMIDDEL]
20 Jul. 1966 18 p In DUTCH
(M-66-606; TDCK-46178) CFSTI: HC $1.00/MF $0.50

Purpose of this study is to shorten, simplify, and standardize procurement inspections and existing regulations. Given for both agents are specifications, property requirements, and inspection methods. Properties that are specified include composition, cleaning and corrosion characteristics, solubility in water, surface tension, pH value, particle size, alkalinity, foaming, and packaging. The inspection methods that are outlined concern in essence the examination of these properties. Instructions for use and safety regulations are briefly outlined for the alkaline lacquer and grease removing agent. Transl. by K.W.

N67-10543# Metaalinstituut TNO, Delft (Netherlands).
SPRAYED METAL COATINGS FOR PROTECTION OF BARE ALUMINIUM ALLOY PARTS IN AIRCRAFT
J. Remmelts 16 May 1966 16 p refs
(M-66-441; TDCK-46042) CFSTI: HC $1.00/MF $0.50

Experiments were conducted to evaluate the influence of sprayed metal coatings on the fatigue strength of aluminium alloy parts. Emphasis was placed on comparisons of corrosion resistance for sprayed metal coatings and paint systems. It was found that resistance against simulated erosion was far better for sprayed metal coatings, and that adhesion of the coating was adequate providing the base material was sufficiently roughened. Experimental procedures, fatigue experiments, and detailed results are included. C.T.C.

N67-10813# Sandia Corp., Albuquerque, N. Mex. Advanced Manufacturing Development Dept.
FUNCTIONAL GAGING WITH OPTICAL PROJECTORS
E. S. Roth Apr. 1966 7 p ref
(Contract AT(29-1)-789)
(SC-R-66-914) CFSTI: HC $1.00/MF $0.50

A discussion is presented on the direct application of functional gaging principles to the inspection of watch-size parts that can be staged on optical projectors. NSA

N67-10900*# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.
DEVELOPMENT OF IMPROVED LOX COMPATIBLE LAMINATED GASKET COMPOSITE Final Summary Report, 16 Jun. 1965–16 Jun. 1966
Don Marano and William G. Sheck Aug. 1966 147 p refs
(Contract NAS8-5053)
(NASA-CR-79703) CFSTI: HC $4.00/MF $1.00 CSCL 11A

Various testing procedures, including load decay, compressive modulus, and leak, were made to develop a new cryogenic gasket compatible with liquid oxygen (LOX). These testing procedures were also employed to demonstrate shortcomings of existing cryogenic gaskets, including fiberglass-filled Teflon, encapsulated, and impregnated asbestos. Data are presented indicating that cold flow is the major problem of fluorocarbon polymers, which are frequently considered because of the LOX compatibility. Attempts were made to restrict the cold flow of the fluorocarbon materials by utilizing various fillers and encapsulated configurations. A glass fabric laminated structure was developed in which the glass fiber bundle was not completely saturated with fluorocarbon polymer binder. This permitted mechanical compressibility, not subject to drastic changes in compressive modulus when exposed to cryogenic temperatures. Some design criteria data are presented along with

a theoretical analysis for predicting flange loads and internal pressure sealing capabilities. Various configurations utilizing the flat gasket concept are described, including O-rings, chevron seals, lip seals, ball seals, diaphragms, and flexible tubing. Process techniques are described for all configurations. Author

N67-10917# California Univ., Livermore. Lawrence Radiation Lab.
FLANGE DESIGN USING ALUMINUM FOIL FOR UHV APPLICATION
T. H. Batzer 25 Jun. 1966 19 p *Its* Eng. Note No. 5505-45
(UCID-4548, Rev. 4; ENA-12) CFSTI: HC $1.00/MF $0.50

Stainless steel flanges and aluminum foil gaskets were developed for bakable ultrahigh vacuum systems. Drawings are included for tube sizes from 1 to 36 inches. NSA

N67-10937# National Academy of Sciences—National Research Council, Washington, D. C.
GUIDE FOR INTERPRETATION OF NON-DESTRUCTIVE TESTS OF WELDS IN SHIP HULL STRUCTURES
Sep. 1966 26 p refs
(Contract NObs-90310)
(SSC-177; AD-639053) CFSTI: HC $2.00/MF $0.50

A survey was made of various Codes and Standards applicable to the interpretation of radiographs of welds and the Guide has been developed for application to welds in ship hull structures of the general cargo, tanker and passenger class as differentiated from naval ships. The Guide exhibits typical X-ray and other non-destructive test results of several classes of defects with suitable text to delineate the maximum size and/or distribution that would be recommended as acceptable for ship hulls Author (TAB)

N67-11002# National Academy of Sciences—National Research Council, Washington, D. C.
MATERIALS EVALUATION TECHNIQUES Aug. 1966 25 p refs
(Contract DA-49-083-OSA-313)
(MAB-225-M; AD-638971) CFSTI: HC $1.00/MF $0.50

Guidelines for materials evaluation are not now available. The need for a Materials Advisory Board study of the subject was considered and endorsed. The proposed study would identify systems, components, environments, design criteria, and relate these factors to test techniques and trade-off approaches. This could permit guidelines to be drawn on recommended approaches to materials evaluation, trade-off studies, development of test techniques, and detail design data generation. The materials evaluation considerations will cover all structural materials except composites and the classically brittle materials Author (TAB)

N67-11090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COVERING OF METAL WITH A PLASTIC LAYER
Sh. Shleymovich and I. Trakhtenberg 7 Jun. 1966 10 p Transl. into ENGLISH from Rechn. Transp. (USSR), v. 23, no. 10, 1964 p 29–30
(FTD-TT-65-1878; TT-66-62338; AD-639439) CFSTI: HC $1.00/MF $0.50

A description is given of experiments in applying polymeric coatings to metals undertaken at the Moscow ship-building and ship-repair plant, at the Kalinin and Leningrad railroad car construction plant and at the Kiev commercial machine construction plant. TAB

N67-11122# Joint Publications Research Service, Washington, D. C.
METHODS AND APPLICATIONS OF FIBER GLASS PRODUCTION
V. A. Shevchenko and Ya. M. Meytin 21 Sep. 1966 15 p Transl. into ENGLISH of excerpts from the book "Sloistyye Plastiki" Kiev, 1964 p 16–18; 104–116
(JPRS-37744; TT-66-34172) CFSTI: $1.00

Several methods of glass fiber production are listed. The list includes information on the method of fiber forming, the mean fiber diameter, and the range of application of articles made from the fibers. A description is also given of a device for the production of pipes made of glass laminates. This machine forms the pipe on a continuously moving mandrel. Some of the characteristics and uses of glass pipes are identified. H.S.W.

N67-11151# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVICE FOR GLUING ELECTRIC RESISTANCE TENSOMETERS TO METAL CONSTRUCTIONS
A. E. Mandel'shtam and A. S. Il'in 28 Jun. 1966 5 p Transl. into ENGLISH from Russian Patent no. 169161 (Appl. no. 873182/23-4, 28 Dec. 1963) 2 p
(FTD-TT-65-1942; AD-639440) CFSTI: HC $1.00/MF $0.50

The object of the invention is a device for glueing on electrical resistance tensometers to metallic constructions by means of heating a polymerizing glue layer to accomplish an effective polymerization of the glue composition from the side of the metal construction. It is designed in the form of nichrome spirals arranged in a flat metallic body covered with an organosilicon electrical-insulation composition with a central opening corresponding to the glueing of the tensometer. Author (TAB)

N67-11171# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPERATION OF CASCADE CONTACT SEALS
A. M. Yevtushenko 31 Aug. 1966 25 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Inst. Zheleznodor. Transp. (Moscow), no. 282, 1964 p 123–142
(FTD-HT-66-281; TT-66-62243; AD-638972) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: operation of cascade contact seals. TAB

N67-11192# Materials Research Lab., Inc., Richton Park, Ill.
INTERPHASE FRACTURING OF COMPOSITE BODIES Final Report, 1 Apr. 1965–1 Apr. 1966
Sheldon Mostovoy and E. J. Ripling Sep. 1966 56 p refs
(Contract NOw-65-0372-c)
(AD-639317) CFSTI: HC $3.00/MF $0.50

Cracking location for short time tests in the Dow epoxy resin (DER) 332, TEPA adhesive was found to depend on composition. At specific ratios of resin to hardener the crack path changed from center of bond (CoB) to interface (IF), depending on adherend material and surface treatment. For compositions where CoB fractures predominate, precracked specimens exposed at zero stress, to either atmospheric humidity or liquid water, showed reinitiation toughness values higher than those seen in prior running or subsequent extension. This toughening is probably a result of the compressive stresses developed in the epoxy by water absorption around the crack tip. Static fatigue exposure of normally CoB precracked specimens was found to cause significant slow crack extension at loads well below those required for rapid extension in short time tests. Debonding occurred starting at one IF directly in line but separated from the preexisting crack. Propagation rates increased as either applied load or humidity was increased. Dynamic fatigue exposure of similarly CoB precracked specimens also showed slow IF crack extension from the initial flaw. Rates of crack extension per cycle for this loading condition were found to be linear, increasing as stress amplitude or humidity was increased. Effects of a given maximum load and humidity were much more severe in the dynamic fatigue case than in the static. TAB

N67-11199# Army Weapons Command, Rock Island, Ill. Research and Engineering Div.
RADIOMETRIC STUDY OF THE WEAR CHARACTERISTICS OF DRY FILM LUBRICANTS Final Report
Elizabeth A. Jennings and Stanley L. Eisler Aug. 1966 15 p refs
(RIA-66-2446; AD-638800) CFSTI: HC $1.00/MF $0.50

The wear life of dry film lubricants as related to percent coating loss was studied by use of a radioactive tracer technique. The contribution to the total wear life by various combinations of the three basic ingredients--molybdenum disulfide, antimony trioxide, and dibasic lead phosphite was studied. Tests were run on a Falex Lubricant Tester to determine the percent coating loss of different formulations for various time periods. Percent coating loss was determined from counting rates of the pins, coated with tagged formulations, before and after testing. The test results indicated a linear relationship between percent coating loss and length of test. It was found that a prediction of the relative wear lives of different formulations could be made on the basis of the percent coating loss results, determined after one hour of testing. TAB

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N67-10283# Florence Univ. (Italy). Inst. of Electromagnetic Waves.
LASER CAVITIES. PART I: RESEARCH ON OPEN RESONATORS. PART II: BEHAVIOR OF THE OUTPUT FROM A MANY ELEMENT LASER Annual Summary Report, 1 Apr. 1965–30 Mar. 1966
P. F. Checcacci, A. M. Schaggi, R. Pratesi, and L. Ronchi 30 Apr. 1966 68 p refs
(Contract AF 61(052)-871)
(ASR-1; AFCRL-66-638; AD-638193) CFSTI: HC $3.00/MF $0.75

A summary of the researches completed during the last year is given along with detailed descriptions of the latest results. Investigation carried out on microwave models of laser resonators and study of new types of open resonators are reported in Part I. Part II is concerned with the study of the time behavior of the light emitted from a many element laser (MEL) Author (TAB)

N67-10437# Library of Congress, Washington, D. C. Aerospace Technology Div.
BLEACHING MECHANISM OF ORGANIC PHOTOTROPIC SUBSTANCES USED IN RUBY LASERS AS SWITCHES Surveys of Foreign Scientific and Technical Literature
Frances Mc Dowell 26 Sep. 1966 9 p refs Transl. into ENGLISH from Zh. Prik. Spektroskopii (USSR), v. 4, no. 5, 1966 p 410–414
(ATD-66-119)

The bleaching process of organic phototropic switches under the effect of ruby laser emission is examined. The effect of the atomic constants of solutions on the bleaching process is evaluated. Author

N67-10585# Polytechnic Inst. of Brooklyn, N. Y. Microwave Research Inst.
OPTICAL RESONATORS IN UNIAXIALLY ANISOTROPIC MEDIA
Leonard Bergstein and Thomas H. Zachos May 1966 73 p refs (Contract AF 49(638)-1402)
(PIBMRI-1333-66; AD-638304) CFSTI: HC $3.00/MF $0.75

Two flat or curved mirror surfaces facing each other form an optical resonator. The problem of diffraction of electromagnetic waves in optical resonators has been extensively studied recently, primarily because of their importance as resonant cavities for laser applications. The problem most generally considered assumes that the resonator is embedded in a linear, homogeneous, isotropic medium. In this study a departure from the idealized medium is made to investigate the effects of diffraction on the electromagnetic field in an optic resonator embedded in an infinite, uniaxially anisotropic medium which is otherwise assumed to be linear and homogeneneous. The direction of the optic axis of the medium is allowed to assume an arbitrary orientation relative to the direction of the resonator axis Author (TAB)

N67-10788*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRO-OPTIC LIGHT MODULATORS
E. Hirschmann Washington, NASA, Nov. 1966 17 p refs
(NASA-TN-D-3678) CFSTI: HC $1.00/MF $0.50 CSCL 20E

This report discusses the performance of KD_2P, GaAs and HMTA light modulators. The KD_2P crystals have given excellent results in modulating a laser beam. Alignment of the crystal with relation to the light beam is very critical. GaAs appears at this time to be the best electro-optic crystal material for a light modulator in the infrared region between 0.9 and 16 microns. Strain-free GaAs can be grown with resistivities exceeding 10^6 ohm-cm. At this time, the use of HMTA as a light modulator material does not appear promising. Author

N67-10950# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
INVESTIGATIONS OF GIANT PULSING METHODS IN RUBY LASERS
David Roy Dean and R. J. Collins Aug. 1966 81 p refs
(Contract Nonr-710(61))
(TR-4; AD-637825) CFSTI: HC $3.00/MF $0.75

The findings from investigations into producing giant optical radiation pulses from ruby lasers by control of static cavity geometry are discussed, the experimental evidence produced by the investigations is presented, and a phenomenological model is proposed. Optimum ranges for the cavity parameters of length, mirror reflectivity, and misalignment are established. For the new giant pulsing method the output pulses produced by the static cavity geometry control method have been found to be similar to the output pulses obtained by the present conventional giant pulsing methods Author (TAB)

N67-11161# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTERFERENCE MEASUREMENT OF HOMOGENEITY OF RUBY RESONATOR FOR THE LASER
V. Bocer and V. Kment 31 Aug. 1966 13 p refs Transl. into ENGLISH from Jemna Mechanika a Optika (Czechoslovakia), no. 1, 1965 p 5–6
(FTD-TT-66-44; TT-66-62249; AD-638978) CFSTI: HC $1.00/MF $0.50

The report describes experience with interference control of the homogeneity of ruby stick (resonator) for laser. An Askenia IG 140 interferometer was used in the arrangement of the Michelson interferometer with the use of lines 6438 A Cd and 6328 A He-Ne lasers Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N67-10031# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
PRODUCING THICK OXIDE LAYERS ON Zr–Ti ALLOYS FOR ENHANCED WEAR RESISTANCE IN WATER-LUBRICATED MECHANISMS
R. D. Watson Jun. 1966 27 p refs
(AECL-2537) CFSTI: HC $2.00/MF $0.50

Five Zr–Ti binary alloys having compositions in the range Zr-0.5 wt% Ti to Zr-10 wt% Ti were investigated for oxide-film-forming characteristics in air at temperatures between 300 and 800°C. Under certain conditions a reasonably thick uniform and tightly adherent oxide layer can be formed on all five materials. Black oxide layers up to 0.0035 in. thick can be produced at temperatures of 700 to 800°C; white or off-white layers up to 0.008 in. thick can be formed at temperatures of 350 to 400°C. The titanium content of the alloys has a pronounced effect on the colour, thickness and quality of the oxide layer. About 22 different oxide coatings were wear tested in water at room temperature. A number of the coatings had excellent wear resistance but the coatings produced by heating Zr-10 wt% Ti and Zr-5 wt% Ti in air at 400°C for 65 h were best. A number of oxidized specimens were corrosion tested in water at 260, 177 and 77°C. At 77°C the corrosion resistance was generally very good; at 260°C the corrosion resistance was unsatisfactory. Author

N67-10081# Joint Publications Research Service, Washington, D. C.
INTERNAL FRICTION IN METALS AND ALLOYS
4 Oct. 1966 31 p refs Transl. into ENGLISH from "Vnutrenneye Treniye v Metallakh i Splavakh" Moscow, Inst. of Met. imemi Baykov, AN SSR, 1966
(JPRS-37980; TT-66-34407) CFSTI: $1.00

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4. DEVICE FOR MEASURING INTERNAL FRICTION IN THE KILOCYCLE FREQUENCY RANGE V. I. Razumov and V. S. Postnikov p 14–18 (See N67-10085 01-14)
5. DIFFUSION INTERNAL FRICTION IN POLYCRYSTALS T. D. Shermeigor and B. M. Darinskiy p 19–23 refs (See N67-19–23 refs (See N67-10086 01-17)

N67-10082# Joint Publications Research Service, Washington, D. C.
INTERNAL FRICTION IN BORON
F. N. Tavadze et al *In its* Internal Friction in Metals and Alloys 4 Oct. 1966 p 1–2 (See N67-10081 01-17) CFSTI: $1.00

Experiments were conducted to obtain pure monocrystalline boron by zone refining, and temperature dependence of the internal friction of boron was studied in order to obtain additional information on the relaxational processes in crystals with covalent-type bonding. When internal friction was studied by the method of damping torsional oscillation from room temperature to 850°C, a clearly pronounced peak (about 1400×10^{-4}) appears at about 260°C Temperature dependence of internal friction and shear modulus in boron is plotted; and it is concluded that grain-boundary relaxational processes do not participate in the peak formation, and that polymorphic transformation does not participate in the emergence of the relaxational effect. M.W.R.

N67-10083# Joint Publications Research Service, Washington, D. C.
TEMPERATURE DEPENDENCE OF INTERNAL FRICTION IN HARDENED IRON AND ALLOY STEEL
S. A. Golovin, V. D Korvachev, and A. N. Titov *In its* Internal Friction in Metals and Alloys 4 Oct. 1966 p 3–8 refs (See N67-10081 01-17) CFSTI: $1.00

Variations in the temperature dependence of internal friction and the physical broadening of the 100 α line are found to be linear in hardened iron and alloy steel; and with increase in degree of cold working, the character of the change in the square of line broadening and in the height of the 200-degree peak varies. Line broadening can be related to changes in microstresses and dimensions of the mosaic block, and thereby contributing to the process of steel hardening. The parameter of the 200-degree peak in alloy steel as a function of hardening temperature differs from that found in nonalloyed steel; a rise in strength and in the 200-degree maximum is noted for carbon steel. The main contribution in the formation of a maximum is attributed to the interaction of dislocations and impurity atoms. M.W.R.

N67-10084 Joint Publications Research Service, Washington, D. C.
INTERNAL FRICTION IN POWDER METAL BERYLLIUM
V. Ye. Ivanov et al *In its* Internal Friction in Metals and Alloys 4 Oct. 1966 p 9–13 refs (See N67-10081 01-17) CFSTI: $1.00

Temperature dependence of internal friction, shear modulus, and elasticity was investigated for hot-pressed powdered beryllium alloys containing BeO. Increasing the BeO content leads to a marked shift in the high temperature region, and a slight rise in peak height accompanied by a reduction in its width. At lower temperatures, there is a weak dependence of modulus value on BeO content; and a marked relaxation of the modulus is noted with temperature increases. As BeO content increases, there is hardening of both the grains and the boundaries; and this leads to suppression of shear processes. The higher temperature is thus required to realize the relaxational process. In these hot-pressed specimens, oxide film on the original powder particles are partially attacked and distributed chiefly along the grain boundaries. Hot pressing promotes setting and sintering, and the formation of a single polycrystalline structure with strong bonds between the particles. M.W.R.

N67-10086# Joint Publications Research Service, Washington, D. C.
DIFFUSION INTERNAL FRICTION IN POLYCRYSTALS
T. D. Shermergor and B. M. Darinskiy *In its* Internal Friction in Metals and Alloys 4 Oct. 1966 p 19–23 refs (See N67-10081 01-17)

Equations are given for the study of internal friction in two adjacent symmetrical hexagonal polycrystal structures; the axis in one is parallel to the direction of elongation, in the other the axis is perpendicular. Diffusion of impurity atoms from the second crystal to the first leads to relaxation of stress and reduction of energy. In cyclic deformation this results in internal friction. Averaging and calculation of effective elastic moduli are used to determine the amount of internal friction; and equations and details are detailed for both of these matehmatical procedures. M.W.R.

N67-10090# Joint Publications Research Service, Washington, D. C.
LITHIUM CORROSION OF METALS 19 Sep. 1966 47 p refs Transl. into ENGLISH from the book "Metallurgiya i Metallovedeniye Chistykh Metallov, No. V" Moscow, 1960
(JPRS-37701; TT-66-34130 CFSTI: $2.00

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1. CARBON BEHAVIOR IN METAL–LIQUID LITHIUM–CARBON SYSTEMS N. M. Beskorovaynyy, V. K. Ivanov, and M. T. Zuyev p 1–20 refs (See N67-10091 01-17)

2. CORRISION MECHANISM OF CARBON STEELS IN LITHIUM N. M. Beskorovaynyy and V. K. Ivanov p 21–32 refs (See N67-10092 01-17)

3. CORROSION OF CHROMIUM–NICKEL STAINLESS STEEL IN LITHIUM N. M. Beskorovanynyy, V. K. Ivanov, and V. V. Petrashko p 33–41 refs (See N67-10093 01-17)

N67-10091# Joint Publications Research Service, Washington, D. C.

CARBON BEHAVIOR IN METAL–LIQUID LITHIUM–CARBON SYSTEMS

N. M. Beskorovaynyy, V. K. Ivanov, and M. T. Zuyev *In its* Lithium Corrosion of Metals 19 Sep. 1966 p 1–20 refs (See N67-10090 01-17) CFSTI: $2.00

It is reported that the behavior of carbon can be determined by the relationship between the values which characterize the chemical affinity for carbon by metal and by the lithium. The chemical affinity of a metal for carbon is estimated by using the value of the free energy released by the metal carbide formation. Curves calculated for the solid phase, without taking into account the solubility of carbon in these metals, show that it is possible to learn about the processes taking place in Me–Li (liquid)C systems, at least in those cases where the thermodynamic durabilities of the carbides of lithium and of the metal differ considerably. It is also noted that the use of radioactive C^{14} isotopes make it possible to determine qualitatively the relative location of the free energy curves in carbide formation cases. A.G.O.

N67-10092# Joint Publications Research Service, Washington, D. C.

CORROSION MECHANISM OF CARBON STEELS IN LITHIUM

N. M. Beskorovaynyy and V. K. Ivanov *In its* Lithium Corrosion of Metals 19 Sep. 1966 p 21–32 refs (see N67-10090 01-17) CFSTI: $2.00

Results are reported from metallographic investigations of the processes which take place when carbon steels are in contact with liquid lithium. Thermodynamic calculations indicate that, up to temperatures of 723°C, the destruction of carbon steels by corrosion is due to the reactive penetration of lithium into steel as a result of an interaction with the cementite. It is also pointed out that the formation of lithium carbide and its subsequent dissolution are accompanied by an increase in volume. The resulting stresses lead to plastic deformation of the corrosion zone. Different changes in volume at the surface and in depth of the corrosion zone lead to the appearance of a complex stressed state in the specimens which affects the course of the corrosion process and the shape of the lithium diffusion curves. A.G.O.

N67-10093# Joint Publications Research Service, Washington, D. C.

CORROSION OF CHROMIUM-NICKEL STAINLESS STEEL IN LITHIUM

N. M. Beskorovaynyy, V. K. Ivanov, and V. V. Petrashko *In its* Lithium Corrosion of Metals 19 Sep. 1966 p 33–41 refs (See N67-10090 01-17) CFSTI: $2.00

Results are presented from studies of the low corrosion resistance of chromium-nickel steel in lithium. It is reported that the corrosion of austenite chromium-nickel steel in contact with lithium at 700°C is due to a reduced content of chromium and nickel in the surface layer. Consequently, this layer becomes porous and impairs the plastic properties of the steel. It is also noted that carbon impurities in lithium significantly affect the degree of steel corrosion in lithium and reduce the concentration of chromium and nickel in the surface layers. A.G.O.

N67-10098# Library of Congress, Washington, D. C. Aerospace Technology Div.

RELATIONSHIP BETWEEN INTERATOMIC REACTIONS AND ADSORPTION-INDUCED STRENGTH DETERIORATION UNDER THE EFFECT OF LIQUID METALS

Dimitri Vvedensky *In its* Foreign Sci. Bull., Vol. 2, No. 9 Sep. 1966 p 21–24 ref (See N67-10096 01-23)

An attempt is made to explain "selectivity" in the effect of liquid metals on solid metals, i.e., why some metals lose their strength and ductility in contact with liquid metals while others under the same conditions show no adverse effects. The reduction of the free surface energy of solid metal is considered a basic factor in the adverse effect of liquid metals, and the extent of this reduction depends on the qualitative and quantitative nature of the possible reactions between the atoms of solid and liquid metals. The possibility of these reactions is determined by the character of the metals involved, their electron structure, their phase diagram, and the value of the heat of mixing. Author

N67-10155# Metaalinstutuut TNO, Delft (Netherlands).

TESTING OF TANK ARMOR PLATE [ONDERZOEK VAN TANKMATERIAAL]

W. Hagg 14 Jul. 1966 10 p In DUTCH

(TDCK-46113; M-66-613) CFSTI: HC $1.00/MF $0.50

Armor plate characteristics of the following tanks were analyzed and compared: Centurion, Stackhound, Chaffee Scild, and Sherman. Performed were tests to determine tensile strength, bending strength, notch toughness, and chemical composition. Photographs showing the microstructure of the alloys are included. The mechanical properties of the alloys were found to differ only insignificantly. Transl. by K.W.

N67-10206*# National Aeronautics and Space Administration, Washington, D. C.

A REFRACTORY MATERIAL RESISTANT TO THERMAL SHOCK: IMPREGNATED TANTALUM CARBIDE

André Hivert Sep. 1966 25 p refs Transl. into ENGLISH of ONERA Rept. No. TP-323 Presented at the Conf. on Mater. for Use in Space, Paris, 7–11 Feb. 1966

(NASA-TT-F-10249) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Evaluation of the refractory properties and resistance to thermal shock of sintered tantalum carbide impregnated with copper or silver at high temperatures are discussed. It was found that the process of impregnation was inhibited at temperatures of about 100°C by a film of tantalum oxide but that, upon heating to 1750°C, the oxide film reacted with the carbon in the tantalum carbide, thus making impregnation practical. Various tests indicated that the effect of tantalum–carbide impregnation with a metal which is a good conductor of heat results in greatly improved resistance to thermal shock. While impregnation slows down the rate of oxidation in air it does not eliminate it entirely, so that the same restrictions in regard to oxidizing atmospheres apply as for graphite. Author

N67-10209*# National Aeronautics and Space Administration, Washington, D. C.

PHASE EQUILIBRIUM DIAGRAM OF THE HF-TA SYSTEM [DIAGRAMMA FAZOVYKH RAVNOVESIY SISTEMY HF-TA V TVERDOM SOSTOYANII]

V. N. Svechnikov, A. K. Shurin, and G. P. Dmitriyeva Sep. 1966 11 p refs Transl. into ENGLISH from Sb. Nauchn. Rabot Inst. Metallofiz., Akad. Nauk Ukr. SSR (Kiev), v. 19, 1964 p 206–211

(NASA-TT-F-10280) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The authors discuss phase diagrams of the hafnium-tantalum system in the solid state. They present X-ray diffraction patterns of the various alloys with α, β, ω single- and two-phase regions. Author

N67-10255# Army Materials Research Agency, Watertown, Mass.
WETTING AND BONDING BETWEEN ALUMINUM ALLOYS AND SAPPHIRE
Stanley M. Wolf, Albert P. Levitt, and James Brown Jul. 1966 18p refs
(AMRA-TR-66-19; AD-638523) CFSTI: HC $1.00/MF $0.50

Wetting and bonding between the basal plane of single crystal sapphire and several aluminum alloys were investigated by the sessile drop technique at 1300 F and 1600 F in vacuo of 0.0001 torr. The alloys were commercially pure (99+ percent) aluminum, commercially pure aluminum with small additions of each of eleven elements, and three commercial aluminum alloys. Additions of zirconium, magnesium, and copper lowered the aluminum-sapphire equilibrium contact angle; the lowest contact angle observed was 94 degrees and was obtained with 0.94 atomic percent addition of magnesium to pure aluminum. The contact angle was not affected by additions of lead, vanadium, manganese, chromium, and bismuth, whereas it was increased by additions of selenium, tellurium, and germanium. Although no general relationship was observed for the effect of the alloying elements on the aluminum-sapphire bond strength, the highest strengths (up to 13,000 psi) were observed when failure occurred in the metal rather than at the interface. Metallographic examination of the aluminum-sapphire interfaces indicated that when the temperatures of the molten alloys were less than 1700 F, the depth of the interfacial zones in the sapphire was less than 0.1 micron
Author (TAB)

N67-10273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NITRIDING OF TITANIUM ALLOYS AT REDUCED PRESSURES
Ye. V. Novikova 23 May 1966 14 p refs Transl. into ENGLISH from Tr. Inst. Met. Im. A. A. Baikova, Akad. Nauk SSSR, "Metallovedeniye Titana" (Moscow), 1964 p 132–138
(FTD-TT-65-1630; TT-66-61960; AD-636676) CFSTI: HC $1.00/MF $0.50

A reduction in pressure in chamber at the nitriding of titanium alloys from 760 to 1–0.1 mm Hg leads to an increase in depth of the nitrided layer by 1.5 to 2.0 times. The thickness of the brittle nitrided zone decreases by several times. It was established that for each titanium alloy, at same temperature and nitriding duration conditions, there should exist definite pressures and nitrogen consumption at which it is possible to obtain a maximum depth of the layer. The layer obtained in rarefied nitrogen has good wear resistance and is not inferior to the layer obtained by nitriding in normal pressure. Mechanical characteristics of sample core of VT4 alloy, after nitriding in rarefied nitrogen, differs little from the nature obtained on samples nitrided at normal pressures (strength limit and impact ductility increase somewhat; relative elongation and narrowing remain practically the same). Author (TAB)

N67-10282# Army Materials Research Agency, Watertown, Mass.
LOCALIZED NECKING IN ANISOTROPIC TITANIUM SHEET TENSILE SPECIMENS
James W. Waters Jul. 1966 17 p refs
(AMRA-TR-66-17; AD-638298) CFSTI: HC $1.00/MF $0.50

A study was made of the orientation of the secondary neck (through the thickness) for anisotropic titanium sheet specimens. This study was a comparison of experimental results with the predictions of Hills theory in terms of the directions of the principal strains in tension. In general, the experimental results agreed qualitatively with theoretical determinations. Quantitative agreement was not obtained. Differences between theoretical and experimental derivations are discussed relative to the accuracy of the experimental procedure. The influence of shear on the orientation of the neck is also reported Author (TAB)

N67-10329# Picatinny Arsenal, Dover, N. J. Pyrotechnics Lab.
COMPARISON OF MECHANICALLY BALLED MAGNESIUM WITH ATOMIZED MAGNESIUM FOR USE IN PYROTECHNIC COMPOSITIONS
James A. Carrazza, Jr., Doris E. Middlebrooks, and Seymour M. Kaye Sep. 1966 52 p refs
(PA-TR-3364; AD-638132) CFSTI: HC $3.00/MF $0.50

Results of a variety of physical and chemical tests indicate that, with a few minor exceptions, balled magnesium meets the requirements of Military Specification 14067-A for 30/50 mesh magnesium powder. The balled magnesium was found to be less reactive than the currently prescribed atomized magnesium, both with water and as a result of exposure to high relative humidities, as determined by gas evolution, weight gain, and surface area measurements. Results of vacuum stability tests at 167F and 230F for thirty days indicate that the balled magnesium has greater stability than atomized magnesium; the thermochemical and sensitivity data for balled magnesium and atomized magnesium are comparable. In performance characteristics such as candlepower, burning rate, and luminous efficiency, similar results were obtained with the two materials. These results indicate that the Reade balled magnesium can be used as an alternate for atomized 30/50 mesh magnesium in consolidated pyrotechnic compositions
Author (TAB)

N67-10335# IIT Research Inst., Chicago, Ill. Metallurgical Engineering Dept.
SHORT-RANGE FORCES IN ALLOYS Final Report
Leonid V. Azaroff 15 Jul. 1966 7 p refs
(Contract Nonr-1406(07))
(AD-638216) CFSTI: HC $1.00/MF $0.50

An investigation was made by absorption spectroscopy to ascertain the electronic structures of alloys. It was found that the rigid-band model is applicable to certain alloys and not to others. It was proven that when it is not applicable, the bonding is more covalent than metallic in character, thus suggesting that bonding rather than simple electronic concentrations must be considered in alloys. This was further confirmed in the examination of the electron compounds (Hume-Rothery phases) having the CsCl structure Author (TAB)

N67-10380# Southern Research Inst., Birmingham, Ala.
THE MECHANICAL AND THERMAL PROPERTIES OF TUNGSTEN AND TZM SHEET PRODUCED IN THE REFRACTORY METAL SHEET ROLLING PROGRAM, PART I
31 Aug. 1966 200 p refs
(Contract N600(19)-59530)
(Rept.-7563-1479-XII, AD-638631) CFSTI: HC $5.00/MF $1.25

The report describes an evaluation program that was performed to obtain preliminary design data for tungsten and TZM sheet produced in the Refractory Metal Sheet Rolling Program. Tungsten sheet 0.060- and 0.10-in. thick, and TZM sheet 0.020-, 0.040-, and 0.060-in. thick, were investigated. Both materials were studied in the optimum (warm worked and stress relieved) and recrystallized conditions. Mechanical properties evaluated included tensile, notched-tensile, compression, bearing, shear, creep, thermal-stability, weld joint efficiency. The recrystallization and bend-transition temperatures were also determined. Physical properties that were evaluated included density, thermal expansion, thermal conductivity and specific heat. Tensile and bend evaluations were performed on the TZM sheet after application of two commercial coatings, PFR-6 and W-3 Author (TAB)

N67-10458# Naval Weapons Lab., Dahlgren, Va.
THE THEORETICAL PRESSURE DEPENDENCE OF THE ELASTIC CONSTANTS IN FACE CENTERED CUBIC METALS
Millard F. Rose 19 Aug. 1966 19p refs
(NWL-2055; AD-637936) CFSTI: HC $1.00/MF $0.50

The Rydberg potential function was used to calculate the second and third order elastic constants for Cu, Ag, Al and Ni. The pressure dependence of the usual elastic moduli were evaluated in terms of these and compared with experimental data wherever possible. The results indicate that the dominant contribution to the third order constants is due to closed shell repulsion between ionic cores. Because of the central character of closed shell repulsion, it is thought that the Cauchy relations are approximately valid for metals at high pressures. Author (TAB)

N67-10507# Massachusetts Inst. of Tech., Cambridge. Metallurgy Dept.
THE OPERATION OF BRITTLE FRACTURE MECHANISMS IN DUCTILE METAL COMPOSITES
John P. Kershaw and Lawrence A. Shepard Dec. 1965 24 p refs
(Contract AF 49(638)-1463)
(ASRL-TR-132-3; AFOSR-66-1669; AD-638621) CFSTI: HC $1.00/MF $0.50

Experiments with W-Fe-Ni and Fe-Ag composites are described. The former consists of continuously bonded rounded tungsten grains in a FCC solid solution matrix of W-Fe-Ni, while the latter consists of a regular grain structure with silver dispersed in the grain boundaries and through the grains. Griffith cracks, concentrated slip, and the effects of twin intersection in these composites are described. It is concluded that the softer matrix phase provides a mechanism whereby the stress concentrations in the harder phase are relieved, thus leading to ductile behavior of the composite. Author (TAB)

N67-10522# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
MEASURING PERCENT ALPHA IN DELTA STABILIZED PLUTONIUM ALLOYS BY X-RAY TECHNIQUES
R. J. Jackson, R. J. Pinkney, and R. R. Mc Donald 15 Jun. 1966 9 p refs
(Contract AT(29-1)-1106)
(RFP-708) CFSTI: HC $1.00/MF $0.50

A method for measuring the percent alpha-plutonium in delta-stabilized plutonium alloys is described. The method is nondestructive and utilizes an X-ray diffractometer for the quantitative measure. Author (NSA)

N67-10528# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
THE ROLE OF DISLOCATIONS IN TRANSGRANULAR STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS
Mc Intyre R. Louthan, Jr. Mar. 1966 26 p refs
(Contract AT(07-2)-1)
(DP-1008) CFSTI: HC $2.00/MF $0.50

Studies that correlate dislocation substructure with transgranular stress corrosion cracking in austenic stainless steel are summarized. Evidence is presented to show that the primary role of dislocations in the mechanism of cracking is to provide a continuous supply of localized anodic regions for selective electrochemical attack. The results show that cracking occurs preferentially on the |111| family of planes and that dislocation movement, and therefore deformation, is required in the cracking process. Possible methods of reducing transgranular stress corrosion cracking include any process or alloy change that either inhibits dislocation movement, promotes cross slip, or reduces the tendency for corrosion. Author (NSA)

N67-10601# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
SUPERCONDUCTING TRANSITIONS IN BODY-CENTERED-CUBIC THALLIUM-INDIUM ALLOYS Research and Development Report No. 42
H. L. Luo and R. H. Willens May 1966 11 p refs
(Contract AT(04-3)-221)
(CALT-221-19) CFSTI: HC $1.00/MF $0.50

The structures of quenched In–Tl alloys were studied at low temperatures. Lattice parameters were determined at room temperature and at liquid nitrogen temperatures. The results of measurements of the superconducting transition are tabulated. NSA

N67-10653# Denver Research Inc., Colo.
STUDIES OF THE EFFECT OF INTERSTITIAL ADDITION ON THE PHASE EQUILIBRIA OF THE NIOBIUM-RICH REGION OF THE NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM ALLOY SYSTEMS Quarterly Progress Report, 1 Mar.–1 Jun. 1966
Albert S. Yamamoto Jun. 1966 10 p ref
(Contract AT(11-1)-1092)
(DRI-1092-232; QPR-7)

The effect of small carbon and oxygen additions on the phase equilibria of the niobium-rich region of the niobium–tungsten–hafnium and niobium–tungsten–zirconium alloy systems is investigated. X-ray analysis data obtained in selected oxygen-bearing alloys are reported. In a majority of the niobium–tungsten–hafnium alloys with small oxygen additions, HfO_2 was found to be the sole second phase. The presence of α-Zr was identified in most of the investigated oxygen bearing niobium–tungsten–zirconium alloys. Additional x-ray diffraction studies are being conducted on samples separated by the use of bromine–methanol phase-extraction method. As a result of preliminary work, it was found that this method complements the phase identification data obtained with the conventional method employing alloy filings. Author (NSA)

N67-10673# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
CREEP-RUPTURE PROPERTIES OF FS-85 ALLOY AND THEIR RESPONSE TO HEAT TREATMENT
R. L. Stephenson Jul. 1966 21 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1456) CFSTI: HC $1.00/MF $0.50

Creep–rupture properties are presented for FS-85 (Nb-27% Ta-10% W-1% Zr) to 1000 hr at 982°C, 1093°C, 1204°C, and 1427°C. Substantial improvements in strength at 982°C and 1204°C can be achieved by pretest annealing 1 hr at 1593°C. These improvements are shown to be stable for at least 1000 hr. Pretest annealing at higher temperatures yields inferior properties. A tentative explanation for these effects is offered in terms of precipitate distribution. Author (NSA)

N67-10690# Iowa State Univ. of Science and Technology, Ames.
INFLUENCE OF OXYGEN ON MECHANICAL PROPERTIES OF Nb-5 PERCENT Zr ALLOYS
Rogert Josephus Emilius de Bruyne (M.S. Thesis) May 1966 101 p refs
(Contract W-7405-ENG-82)
(IS-T-92) CFSTI: HC $4.00/MF $0.75

The influence of oxygen in the range from 180 to 1170 ppM on the mechanical properties of the Nb–5% Zr alloys was investigated. The alloys were prepared by arc melting and were, after swaging with an approximate reduction of area of 65%, heat treated for one hour at 1400° C in a vacuum of 10^{-6} Torr. The oxygen was present as a coarse equi-axed ZrO_2 dispersion. The influence on yield and flow stresses was determined by compression tests over a strain-rate range of 0.881×10^{-6} to 0.894×10^{-2} inch per inch per second. The yield stress was nearly independent of the oxygen content and its dependence on the strain rate $\dot{\varepsilon}$ is given by $\sigma_y = 53.500\times(\dot{\varepsilon})^{0.0255}$ psi. The work hardening and the flow stresses, corresponding to the model of Fisher, Hart and Pry, increased

linearly with the volume fraction of the dispersion, which was in turn proportional to the oxygen content, C. An empirical expression for the flow stresses at a strain ϵ (in percent) between 5 and 15% is $(\sigma_f)_{\epsilon,\dot{\epsilon}}$, $C = 49{,}000 \times (\epsilon)^{0.2307} \times (\dot{\epsilon})^{0.0217} + S_{\epsilon,\dot{\epsilon}} \times (C - 180)$ psi where $S_{\epsilon,\dot{\epsilon}}$ is the slope of the curve of the flow stresses as a function of the oxygen content. $S_{\epsilon,\dot{\epsilon}}$ has an average value of 2.07. It was concluded that oxygen was a small effect on the room temperature mechanical properties of these alloys. Author (NSA)

N67-10700# California Univ., Berkeley. Lawrence Radiation Lab.
ON THE MECHANISMS OF DEFORMATION IN DISPERSION-HARDENED ALLOYS
P. Guyot Apr. 1966 33 p refs Presented at 2d Bolton Landing Conf., New York, 27-29 Jun. 1966
(Contract W-7405-ENG-48)
(UCRL-16803; CONF-660626-1) CFSTI: HC $2.00/MF $0.50

The mechanisms of plastic deformation occurring in alloys with a f.c.c. matrix and in which the incoherent second-phase dispersed particles are generally not deformed with the matrix, are described. At low temperatures these mechanisms are well understood. The cutting of the mobile dislocations through the forest agrees with the experimental results; the hardening is due to the steep increase of dislocation density with the strain. The second phase plays an indirect part (pinning or multiplication of dislocations). At a high enough stress (or strain) cross slipping can be induced, determining a cell structure. At high temperatures various processes can be effective: cross slipping and particle limited climb determine the motion of dislocations in the matrix; for temperatures near the melting point of the matrix, these alloys generally present high activation energies steeply varying with the stress, and the thermal activation of the junction reactions between attractive dislocations explains experimental measurements. Author (NSA)

N67-10710# Oak Ridge National Lab., Tenn. Reactor Div.
VAPOR-BUBBLE-GROWTH RATES IN SUPERHEATED LIQUID METALS
R. P. Wichner and H. W. Hoffman Jul. 1966 37 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1413) CFSTI: HC $2.00/MF $0.50

The rate of growth of a vapor bubble in a superheated liquid-metal is derived under the assumption that the liquid temperature remains constant at the equilibrium value required for an arbitrary initial bubble size. Bubble growth results from the disturbance of this equilibrium by the Stokes rise and is limited only by the mass inertia of the displaced liquid. The effects of surface tension and of liquid pressure variation as the bubble rises in the pool are taken into account. A single, dimensionless parameter is found which specifies both the superheat conditions and the bubble rise velocity. Superheats required for pool-boiling K are calculated for a range of initial bubble sizes, pool overpressures, and pool depths. The superheat was found to increase both with decreasing initial bubble size and with decreasing overpressure but was relatively uninfluenced by pool depth. A high rate of energy increase found in the growing bubbles suggests that heat conduction in the liquid K may have a role in specifying the bubble-growth rate. Further since the bubble-growth rates far exceed the bubble rise velocity, the shape of a bubble born on the bottom surface of the pool tends to distort from the original spherical shape. Author (NSA)

N67-10712# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
FATIGUE CRACK PROPAGATION IN LOW-CARBON STEELS
D. F. Mowbray 1 Jun. 1966 9 p refs
(Contract W-31-109-ENG-52)
(TID-23138) CFSTI: HC $1.00/MF $0.50

Results are presented from investigations of A 320 B steel plate specimens with flaw geometry such that cracks emanate from a centrally located through-the-thickness hole. An objective of the tests was to test the hypothesis that crack extension per cycle is controlled by the intensity of the stress field in the vicinity of the crack tip. Results of crack growth analyses indicate that application of the stress intensity factor hypothesis produces good correlation of the data for both test directions. NSA

N67-10757*# Battelle Memorial Inst., Columbus, Ohio.
STEADY-STATE CREEP OF DISPERSION-STRENGTHENED METALS Final Report
B. A. Wilcox and A. H. Clauer 19 Aug. 1966 49 p refs
(Contract NAS3-7615)
(NASA-CR-54639) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The high-temperature creep behavior of recrystallized Ni-ThO_2 alloys has been studied using vacuum constant-stress creep conditons. Five alloys, containing different volume fractions of ThO_2 and different ThO_2 particle-size ranges were creep tested at various stresses (nominally 2,000 to 15,000 psi) and temperatures (nominally 600 to 1050°C). Emphasis was placed on rationalizing the mechanical behavior in terms of the structural changes occurring during creep deformation. Mechanical and structural studies indicated that the rate-controlling creep process was the climb of edge dislocations over ThO_2 particles. A modified version of the Ansel-Weertman climb theory has been developed. The theory relates the steady-state rate to stress, temperature, and the ThO_2 particle size and spacing. Author

N67-10758*# Eitel-McCullough, Inc., San Carlos, Calif.
AN INVESTIGATION OF SOLUBILITY AND DIFFUSION OF OXYGEN IN REFRACTION METALS Quarterly Report, Jan.-Mar. 1966
R. Pape, L. Reed, and R. Mc Rae Apr. 1966 46 p ref
(Contract NAS3-7626)
(NASA-CR-54649; TR-66-19; QR-3) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Electrical resistivity measurements are being used to determine the solubility limits and diffusion constants of oxygen in tantalum, Ta-IOW, alloy T222, columbium, Cb-1% Zr, and Alloy FS-85. Tentative solubility limits have been established for tantalum in the range 600° to 920°C. The limits of solubility range from 770 ppm at 598°C to 2265 ppm at 918°C. Author

N67-10775# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
STRESS-CORROSION CRACKING OF CARBON STEEL IN SIMULATED WASTE SOLUTIONS
L. P. Costas, M. L. Holzworth, and W. C. Rion Jun. 1966 33 p refs
(Contract AT(07-2)-1)
(DP-1023) CFSTI: HC $2.00/MF $0.50

A laboratory corrosion test program was carried out to determine the cause of cracking failure in carbon steel tanks used for the storage of radioactive waste. Welded test specimens (carbon steel plate, 36 inches square × 1/2-inch thick, ASTM A285 Grade B) suffered stress-corrosion cracking in simulated waste solutions containing nitrate. The cracks induced in the laboratory were similar to the cracks observed in the plant. Full stress relief, which prevented stress cracking of the specimens in the test solutions, should be considered for future tanks of this type. Author (NSA)

N67-10806# Temple Univ. Research Inst., Philadelphia, Pa.
BEHAVIOR OF LIQUID AND SOLID GALLIUM ON MERCURY AT ROOM TEMPERATURE AND THE MECHANISM OF ITS DISSOLUTION
A. V. Grosse 30 Apr. 1966 48 p refs
(Contract AT(30-1)-2082)
(NYO-2082-4) CFSTI: HC $2.00/MF $0.50

It is shown that liquid Ga forms a lens or a blister on Hg at room temperature from which a steel-blue film spreads over the whole Hg surface. The time of dissolution for the same quantity of Ga in the same quantity of Hg is shorter the larger the Hg surface area. Simple diffusion theory describes the experimental results quantitatively, under the assumption that the Ga surface film provides a relatively constant Ga surface concentration and that Ga atoms diffuse into the body of the liquid from the entire surface area of the film. Author (NSA)

N67-10807# Commissariat a l'Energie Atomique, Grenoble (France). Section d'Application des Radioelements.
CONTRIBUTION TO THE DETERMINATION OF Sb, Ag, Cu, Ga, Mo, and Zn, USING 14-MeV NEUTRON ACTIVATION [CONTRIBUTION AU DOSAGE DE Sb–Ag–Cu–Ga–Mo–Zn PAR ACTIVATION AUX NEUTRONS DE 14 MeV]
Michel Crambes Apr. 1966 52 p refs In FRENCH
(CEA-R-2965)

By using 14-MeV neutron irradiation it is possible to extend the field of application of neutron radioactivation analysis, in particular to the case of light elements. For many other elements it can replace in-pile irradiation thereby making it possible, thanks to portable 14-MeV neutron generators, to carry out radioactivation analyses away from nuclear research centers. Rapid chemical separation methods were developed to make possible the determination of elements which, after exposure to fast neutrons, procude β^+ emitting nuclides which cannot be differentiated by a sample instrumental study, the emitted radiation being of the same type and of similar half life in the two cases. Author (NSA)

N67-10861*# TRW Equipment Labs., Cleveland, Ohio.
DETERMINATION OF ELEVATED-TEMPERATURE FATIGUE DATA ON REFRACTORY ALLOYS IN ULTRA-HIGH VACUUM Eighth Quarterly Report, 1 Apr.–1 Jul. 1966
C. R. Honeycutt, T. F. Martin, and J. C. Sawyer 15 Jul. 1966 29 p ref
(Contract NAS3-6010)
(NASA-CR-72039) CFSTI: HC $2.00/MF $0.50 CSCL 11F

Specimens of TZM alloy, having various notch configurations, were fatigue tested at 2000°F to determine the effect of notch geometry on fatigue strength. Above a notch factor of approximately two, stress values for fatigue failures calculated from classical notch theory produced values which were apparently below those obtained on smooth specimens. Tension-tension fatigue tests conducted on TZC alloy smooth specimens at 2000°F with a 20 Ksi static load and A ratios of 0.1 to 0.4 indicated that the presence of the dynamic load significantly increased the total creep extension. At 2000°F as much as 2.8% creep has been observed in 59 hr at a peak stress of 27.2 Ksi. Author

N67-10862*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Aerospace Sciences Lab.
EMISSIVITY COATINGS FOR LOW-TEMPERATURE SPACE RADIATORS Quarterly Progress Report No. 4, Quarter Ending 30 Jun. 1966
F. J. Smith and J. G. Grammer 30 Jun. 1966 30 p refs
(Contract NAS3-7630)
(NASA-CR-72089; L-23-66-1) CFSTI: HC $2.00/MF $0.50 CSCL 11C

Continuing research on the evaluation of coatings for low temperature spacecraft radiators is reported, including properties and stability of candidate coatings under conditions of exposure to ultraviolet radiation, vacuum of less that 10^{-7} Torr, elevated temperature, and temperature cycling. A modified zinc oxide–methyl silicone coating is described, and the measurement of its optical properties is reported. The apparatus, sample preparation, and procedure of the thermal cycling tests are described, and it was pointed out that neither cracking nor spallation of the coatings was observed by the unaided eye or at 100 X magnification. The exposure test procedure is discussed, and results are presented in tabular and graphical form. L.E.W.

N67-10893*# Battelle Memorial Inst., Columbus, Ohio.
IMPROVEMENT OF CREEP STRENGTH AND LOW-TEMPERATURE DUCTILITY OF REFRACTORY METALS BY MEANS OF MECHANICAL TWINNING Final Report
J. W. Edington 15 Oct. 1966 17 p refs
(Contract NASr-100(05))
(NASA-CR-79710) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Several materials were investigated to determine the possibilities of ductility improvement at low temperatures, and twin strengthening at high temperatures. These included a niobium-40 wt. % vanadium alloy, chosen for evaluating the high temperature strengthening mechanism; niobium and tungsten for evaluating ductility at low temperatures; and a commerical FS 85 niobium alloy to test the hardening effect of deformation twins on a technologically important material. Test procedures are described, and mechanical property data are given. In the experiments on ductibility improvement, it was impossible to introduce mechanical twins without introducing cracks that weakened the material on subsequent testing. In conventional tensile tests, twin strengthening occurred at 600°C in polycrystalline molybdenum-35 at. % rhenium alloy; did not occur at elevated temperatures on polycrystalline niobium, niobium-40 wt. % vanadium alloy, and FS 85 niobium alloy. Under creep conditions at elevated temperatures, twin strengthening did not occur in the FS 85 alloy. M.G.J.

N67-10939# Pennsylvania Univ., Philadelphia. School of Metallurgical Engineering.
AN ELECTRON MICROSCOPE STUDY OF QUENCHED GOLD-PALLADIUM ALLOYS. A STUDY OF THE ELECTRICAL RESISTIVITY CHANGES PRODUCED BY QUENCHING Au Pd ALLOYS. THE EFFECT OF QUENCHED-IN VACANCIES ON THE MECHANICAL PROPERTIES OF GOLD-PALLADIUM ALLOYS
Robert Maddin 30 Sep. 1966 3 p
(Contract Nonr-551(55))
(AD-639056) CFSTI: HC $1.00/MF $0.50

A study was made of point defects in binary alloys. There are three phases of the research, the first concerned with electron microscopy of gold-palladium foils, the second with electrical resistivity changes produced by quenching in similar composition alloys, and the last concerned with the effect of quenching on mechanical properties of these alloys. Author (TAB)

N67-10948# Materials Research Corp., Orangeburg, N. Y.
INVESTIGATION OF ELECTRON BEAM PROCESSING OF ALUMINUM OXIDE AND RELATED MATERIALS
W. Class, Harvey R. Nesor, and O. T. Murray 15 Jun. 1966 50 p refs
(Contract AF 19(628)-4089)
(AFCRL-66-473; SR-4; AD-637800) CFSTI: HC $2.00/MF $0.50

Float-zone crystal growth techniques were applied to the preparation of refractory nonconducting crystals currently of interest to the laser technology. In these studies, sapphire and ruby served as test materials to evaluate the advantages and limitations of the float-zone methods. Two distinct procedures were employed to produce the molten zones in non-conducting materials. An electron beam technique utilizing a self-accelerated electron gun of annular geometry was the first process examined during the program. A second technique - the production of a floating zone by the use of a hollow cathode electrical discharge - was also developed. Both methods yielded single crystals of relatively high perfection as measured by the density of dislocations appearing in the grown crystals. Further evaluation is necessary to fully determine if the optical perfection of these crystals is commensurate with the stringent requirements demanded of a good laser crystal. TAB

N67-10961# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFORMATION OF DEFORMATION RESISTANCE DURING PLASTIC DEFORMATION OF TITANIUM ALLOYS

I. M. Pavlov, Ye. G. Konstantinov, and A. Ye. Shelest 6 Jun. 1966 11 p refs Transl. into ENGLISH from Tr. Inst. Met. Akad. Nauk SSSR (Moscow), 1964 p 28–31

(FTD-TT-65-1087; TT-66-62346; AD-639484) CFSTI: HC $1.00/MF $0.50

Conclusions: (1) The obtained strength and plasticity characteristics of titanium alloys VT1, OT4, VT6, and VT14 were at a linear stressed state in conditions of static and dynamic actions of forces. (2) Comparison of deformation resistance of the mentioned alloys at various deformation rates shows, that in theoretical calculations values sigma sub (B) (ST) in a temperature range of hot pressure treatment (700–1000° C) can be used. (3) The ultimate strength sigma sub B sub D, obtained at dynamic elongation in the very same temperature range, is situated above the actual and calculated deformation resistances, which is explained by more considerable rates of deformation during dynamic elongation. (4) Plastic properties of alloys VT1, OT4, VT6, and VT14 (relative elongation and narrowing of the transverse section) decrease with an increase in rate of deformation.

Author (TAB)

N67-10992# Watervliet Arsenal, N. Y. Benet Labs.

EVALUATION OF ELECTRODEPOSITED COPPER, LEAD, AND LEAD–TIN ALLOY (93-7%) BEARING SURFACES FOR SWAGING CANNON BORES

V. Peter Greco Apr. 1966 29 p refs

(WVT-6608; AD-637183) CFSTI: HC $2.00/MF $0.50

Electrodeposits of copper, lead, and lead-tin were evaluated as bearing surfaces for swaging steel cylinder bores. Drive pressure-time curves for the traveling mandrel are reviewed and discussed. The relationship between bearing surface characteristics of swaged cylinders and the behavior of the traveling mandrel were established. Metallographic and x-ray (back reflection Laue Method) examinations are discussed and photographs are shown to exemplify bearing surface characteristics after swaging. Contrasting results are shown for the behavior of copper (exemplifying stick-slip motion) as compared to lead and lead-tin surfaces. Some results are also reported for tin and zinc electrodeposits. Average pressure-time curves from production runs are presented and compared with experimental lead and lead-tin tests. The evaluation has shown that lead is generally the best bearing material for the swaged tubes examined

Author (TAB)

N67-11021# Franklin Inst., Philadelphia, Pa. Research Labs.

THE MICROSTRAIN REGION IN HIGH-PURITY REFRACTORY METALS Second Quarterly Report, Jun. 1–Aug. 31, 1966

H. L. Prekel, Alan Lawley, and John D. Meakin 31 Aug. 1966 21 p refs

(Contract Nonr-4434(00))

(Q-B2195-2; AD-639603) CFSTI: HC $1.00/MF $0.50

It is shown that the hydrogen annealing treatmets (described in AD-639 603) which are required in the preparation of molybdenum single crystals suitable for dislocation velocity experiments leave the remaining dislocations in an unpinned state. Some tentative dislocation velocity determinations are presented leading to an activation volume v* approx 20b to the third power in agreement with values of v* = 15b to the third power found by strain-rate change experiments in the macro-strain region. The micro-strain behavior of molybdenum single crystals treated in hydrogen in a similar fasion is examined. The true elastic limit tau sub E, the dissipative friction stress tau sub F, and the activation volume v* are found to be: tau sub E = 0.07 plus or minus 0.0002 Kg/sq, tau sub F = 0.04 plus or minus Kg/sq mm and v* approx 1700b to the third power. These results are compared to those obtained with as zone-refined crystals

Author (TAB)

N67-11034# Naval Research Lab., Washington, D. C.

OBSERVATIONS ON MICRO-MECHANISMS OF FATIGUE CRACK PROPAGATION IN 2024 ALUMINUM

D. A. Meyn Jun. 1966 42 p refs

(NRL-MR-1707; AD-638904) CFSTI: HC $2.00/MF $0.50

The propagation of fatigue cracks in 2024-T3 aluminum in air was observed to occur by two different mechanisms depending upon the crack tip stress amplitude. Propagation at low amplitudes developed striations of extreme flatness usually separated by fissures. A study of matched areas from mating fracture surfaces in the electron microscope showed that the flat and fissured sections of each striation on one fracture surface mated respectively with the flat and fissured sections on the other fracture surface. It was concluded that low amplitudes encouraged propagation by an environmentally aided mechanism, as suggested by P. J. E. Forsyth, and his basic model was adopted. Propagation at high amplitudes produced striations showing evidence of extensive local plastic deformation: isolated tear dimples were common, slip lines were well developed on the striations, and the striations were of a ridge-and-valley contour. Study of matched areas of mating fracture surfaces indicated that ridges and valleys matched ridges and valleys, respectively. A model such as proposed by McEvily, Boettner and Johnston for plastics, involving ductile tearing and compressive resharpening at the crack tip, was adopted to explain the observations made

Author (TAB)

N67-11071# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMAL AND DILATOMETRIC EFFECTS DURING ANNEALING OF DEFORMED ZIRCONIUM

B. F. Slyusar 23 Feb. 1966 10 p refs Transl. into ENGLISH from Sb. Nauchn. Rabot Inst. Metallofiz., Akad. Nauk Ukr. SSR (Kiev), no. 17, 1963 p 68–71

(FTD-TT-65-1488; TT-66-62315; AD-639335) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: thermal and dilatometric effects during annealing of deformed zirconium.

TAB

N67-11083# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A STATISTICAL AND METALLOGRAPHICAL STUDY OF MECHANICAL PROPERTIES OF FERRITIC MAGNESIUM CAST IRON

A. M. Gupta 25 Apr. 1966 11 p Transl. into ENGLISH from Slevarenstvi (Prague), v. 12, no. 8, 1964 p 316–318

(FTD-TT-65-1823; TT-66-62239; AD-638900) CFSTI: HC $1.00/MF $0.50

Statistical evaluation showed that the composition of the basic cast iron is perfectly uniform and corresponds to the desired composition. That is why it is impossible to see the cause of mechanical properties fluctuation in chemical compound. The diagrams which are the results of statistical investigation showed further interested dependences: a. It appears, that to a definite tensile strength value and of the extension exist line are dependences between both values. These dependences will come into disorder if the tensile strength value will exceed a definite limit. b. In dependence upon the metal value and form of the separated graphite in the area higher than tensile strength varies ductility at a definite strength value in a considerable degree. It was established by metallographic investigations, that the microstructures of the sample are mutually clearly different. The basic metal value was formed mostly by ferrite, which contained graphite grains. If in the structure in addition to granular graphite and ferrite is present a basic amount of scaly graphite or perlite, a drop in ductility appears in comparison with the material of identical strength. Ductility is lower by the fact that the greater amount of scaly graphite and

perlite in the structure occurs. The extremely very low tensile strength and very low ductility is due to the presence of a greater amount of scaly graphite in the entire area of the polishing. Graphite grains are used on the polished area only in very small number and size. TAB

N67-11087# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT THE RELATION OF RECRYSTALLIZATION KINETICS WITH THE RELAXATION OF TENSIONS IN METALS
L. N. Aleksandrov and V. N. Orlov 7 Jun. 1966 11 p refs Transl. into ENGLISH from the Publ. "Relaksatsionnyye Yavleniya v Metallakh i Splavakh" Moscow, Metallurgizdat., 1963 p 294–299
(FTD-TT-65-1872; TT-66-62361-AD-639555) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: about the relation of recrystallization kinetics with the relaxation of tensions in metals. TAB

N67-11089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WITH RESPECT TO THE NATURE OF PLASTIC DEFORMATION AT SUPERSONIC VELOCITY ON DEFORMATION
Khr. Kortenski and Iv. B"Chvarov 7 Jun. 1966 11 p ref Transl. into ENGLISH from Mashinostr. (Kiev), no. 12, 1964 p 29–32
(FTD-TT-65-1877; TT-66-62366; AD-639597) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: with respect to the nature of plastic deformation at supersonic velocity on deformation. TAB

N67-11124# Library of Congress, Washington, D. C. Aerospace Technology Div.
INVESTIGATION OF THE OXIDATION RESISTANCE OF ZIRCONIUM BORIDE-MOLYBDENUM DISILICIDE ALLOYS [ISSLEDOVANIYE OKALINOSTOYKOSTI SPLAVOV BORIDA TSIRKONIYA S DISILITSIDOM MOLIBDENA]
Bartholomew Poplawski 30 Aug. 1966 5 p refs Transl. into ENGLISH from Poroshkovaya Met. (Kiev), no. 10, 1965 p 75–79 (ATD-66-73)

This work examines the oxidation resistance of pure zirconium boride and zirconium boride-molybdenum disilicide alloys. It was found that the oxidation resistance of the zirconium boride-molybdenum disilicide alloys considerable exceeds that of pure zirconium boride, which, like all the other borides of transition metals, begins to oxidize in an oxygen or air medium at temperatures of only 700–800°C. The present article describes the process by which they oxidize the specimens. The zirconium boride specimens do not disintegrate, however, because it was found that they are covered with a protective film. Protective films are also formed in the oxidation process of the zirconium boride-molybdenum disilicide alloys, this process differing from that of pure zirconium boride. The films are analyzed and their effect is discussed. The authors explain the reason for the higher protective properties of the films formed on the alloys as compared to those formed on pure zirconium boride and they conclude that the zirconium boride-molybdenum disilicide alloys possess an exceptionally high oxidation resistance and can be used at temperatures up to 1500–1550°C. Author

N67-11132# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
INTERMEDIATE PHASES IN THE MAGNESIUM-CERIUM SYSTEM BETWEEN MAGNESIUM AND Mg_3 Ce
R. L. Crosby and J. L. Holman 1966 23 p refs
(BM-RI-6866)

Microscopical and X-ray diffraction techniques were used to identify two intermediate phases in that part of the solid region of the magnesium-cerium system between magnesium and Mg_3Ce. Previous literature had reported only one intermediate phase for this region, but chemical analysis determined the approximate composition of the two compounds to be $Mg_{23}Ce_2$ and $Mg_{17}Ce_2$. The range in composition of the two intermediate phases was found to be limited to less than 0.3 atomic percent cerium. The sutdy did not determine the crystal structure of $Mg_{17}Ce_2$, but that of $Mg_{23}Ce_2$ is tetragonal with a = 10.33 A and c = 19.51 A. Author

N67-11141# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MECHANISM OF OXIDATION OF SOME Ni-Cr-BASED ALLOYS
D. V. Ignatov and R. D. Shamgunova 17 Jun. 1966 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Met. i Toplivo (Moscow), no. 3, 1959 p 83–87
(FTD-TT-65-1919; TT-66-62335; AD-639461) CFSTI: HC $1.00/MF $0.50

Conclusions: (1) The rate of the oxidation of the binary alloy 80% Ni - 20% Cr is lower than the rate of oxidation of chromium at the temperature of 800–1000 C. The cause of the greater heat resistance of the alloy, as compared with chromium, is to be found in the formation on the surface of the alloy of an oxide film, the outside layer of which consists of NiCr204 and a higher energy of the transition of the ions of the chromium into the oxide film from the alloy, as compared with pure chromium. (2) The rate of the oxidation of the nichrome alloy falls with the addition of aluminum. The effect of the aluminum appears plainly with the temperature above 700 C. For successful protection of the alloy Ni-Cr from oxidation up to the temperature of 900 C, there is sufficient content of aluminum in the alloy of the amount of 4 to 5%. For protection of the alloy at 1000 C, there is necessary the addition of aluminum to the amount of 7%. Author (TAB)

N67-11187# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
THE VAPOR PRESSURE OF COBALT BETWEEN 1693°K AND 1753°K AND CHEMICAL ACTIVITIES OF COBALT AND PLATINUM IN Co–Pt ALLOYS AT 1693°K
George Ross Winters, II (M.S. Thesis) Jun. 1966 44 p refs
(GAM/MC-66B-8; AD-639421) CFSTI: HC $2.00/MF $0.50

The Knudsen effusion technique was used to determine seven values of the vapor pressure of pure solid cobalt between 1693 K and 1753 K and the vapor pressure of cobalt over five cobalt-platinum alloys at 1693 K, ranging in composition up to fifty-one atomic per cent platinum. Within the temperature range, the vapor pressure of cobalt is given by logP (atm.0 - -22.950/T + 7.57. Third law calculations gave a value for the heat of sublimation of cobalt at 298.15 K of 105,000 plus or minus 800 cal./mole. The activities of cobalt in the experimental alloys were calculated from the quotient of vapor pressures. Cobalt activity coefficients at higher platinum concentrations were extrapolated from a plot of N sub Co/N sub Pt versus ln gamma sub Co, and platinum activity coefficients were determined by graphical integration of the Gibbs-Duhem equation using the same plot. The activities of both cobalt and platinum in the alloys showed large negative deviations from Raoults law. The integral free energies of mixing were determined to be negative, with the most negative value of -8300 cal./mole occuring at about forty-five atomic percent platinum. By then assuming the ideal entropy of mixing to be a limiting maximum value, it was found that the integral enthalpies of mixing must be negative. (Author) TAB

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N67-10051# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE AFFECT OF THE RATE OF THERMAL DEGRADATION ON THE PROCESS OF NON-STATIONARY DETERIORATION OF FIBER GLASS REINFORCED PLASTIC

Yu. V. Polezhayev *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 95–104 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

The interaction between the thermal degradation of organic binder and the melting of the fiber glass reenforcement during plastic deterioration under high temperature gas flow is investigated. The process of degradation inside the vitreous heat resistant layer is outlined, and results of the numerical calculations are discussed. It was concluded that: (1) If gas dynamic processes occur in sufficiently narrow regions, the zones of thermal degradation during heating of solid substances equals up to 15–20% of the heating depth and is narrowed only insignificantly during sharp increase of the reaction rate. (2) The characteristic reaction temperature is an important function of time. N.E.N.

N67-10095# Gt. Brit. Ministry of Aviation, London.

ON THE INTERRELATIONSHIPS BETWEEN THE PHYSICAL PROPERTIES OF POLYMERS: ORGANIC AND INORGANIC POLYMERS [O VZAIMOZAVISTMOSTI FIZICHESKIKH SVOLSTV POLIMEROV: ORGANICHESKIE I NEORGANICHESKIE POLYMEROY]

N. I. Vorobiev Sep. 1966 6 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), v. 8, 1961 p 76–78
(TIL/T-5420) CFSTI: HC $1.00/MF $0.50

The value of the intermolecular forces for polymers is the principle characteristic determining many properties of a substance. The glass transition temperature is also an important parameter, and it is examined as a measure of the mechanical strength of polymeric substances. Author

N67-10128# Autonetics, Anaheim, Calif.

PROPERTIES OF PLASTIC MATERIALS AND HOW THEY RELATE TO DEVICE FAILURE MECHANISMS

S. M. Lee, J. J. Licari, and A. Valles *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 464–492 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contract AF 04(694)-247)

A search was made for factors pertinent to failure mechanisms in microdiode values which entailed design and screening evaluation of various experimental and analytical approaches. The resulting data was reviewed for applicability to known or conjectured failure mechanisms which were applied to these components to verify postulated hypotheses. An ammonia contaminant was discovered in a phenolic molding compound used by a diode manufacturer which produced increased and erratic reverse currents and was more pronounced in the presence of moisture. The presence of ammonia and other deficiences in the molding compound induced an investigation of other materials. The high temperature resistivities of coatings were used as a measure of performance for these materials as protective systems over diodes under high temperature test conditions. In some plastic compounds, a correlation was found between high temperature resistivities and water extract resistivities. Teflon had superior performance under high temperature reverse bias and high humidity reverse bias test conditions. The resistivity of water extracts of evaporants was used to effectively indicate the amount of ionic and other conductive impurities in plastic materials. R.N.A.

N67-10154# Metaalinstituut TNO, Delft (Netherlands).

INVESTIGATION OF THE CORROSION-PREVENTIVE PROPERTIES OF VCI PAPER [ONDERZOEK VAN HET CORROSIEWERENDE GEDRAG VAN VCI-PAPIER]

J. W. Boon 8 Jun. 1966 15 p In DUTCH
(TDCK-46179; C-66-477) CFSTI: HC $1.00/MF $0.50

The investigation was to establish standards and regulations for the selection and procurement of corrosion-preventive papers for military use. Pertinent American and German military specifications are reviewed, and seven test methods to determine various characteristics of the papers are discussed. The tests involve the prevention of corrosion of copper, steel, and aluminum. An original test arrangement using air and water vapor is described in detail, and ten Dutch and German paper samples were tested by this method. Detailed test results are presented. Transl. by K.W.

N67-10238*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.

ISOLATION OF COMPONENTS ON A SILICON WAFER USING SiO_2

Glenn W. Skouson Washington, NASA, Nov. 1966 40 p refs
(Contract NAS5-3758)
(NASA-CR-580) CFSTI: HC $2.00/MF $0.50 CSCL 11B

A feasible method of isolating components on a silicon wafer has been developed which circumvents undesirable parasitic capacitance resulting from standard p-n junctions electrical isolation techniques. The end product is a wafer composed of a polycrystalline substrate and a layer of single crystalline islands isolated from the substrate and each other by a thin layer of SiO_2. Experiments in the vital groove cutting operation using both standard wet chemical and new high temperature HCl etching methods indicate that pending refinements in the latter process, the wet chemical method is preferable. The determining factor is the groove depth limitations of the high temperature process which restricts the thickness of the useful single crystalline n-layer. A series of experiments in depositing silicon dioxide and polycrystalline silicon into etched silicon grooves indicates that silicon dioxide deposited by the reaction of $CO_2 + SiCl_4$ in the presence of hydrogen is useful as a dielectric and that successful polycrystalline growth can be accomplished. Author

N67-10251*# Southern Research Inst., Birmingham, Ala.

THE PERMEABILITIES OF THREE POROUS GRAPHITES Final Report

C. M. Pyron, Jr. and C. D. Pears 11 Oct. 1966 25 p ref
(Contract NAS1-5448)
(NASA-CR-66212; Rept.-8059-1728-2-III) CFSTI: HC $1.00/MF $0.50 CSCL 11B

Variations were found with pressure and temperature when the permeabilities of three porous graphites were measured from room temperature to 1000°F in gaseous nitrogen and helium. Admittance is measured by the sum of the viscous and molecular flows. If viscous flow predominates, the resultant curve increases linearly with pressure and decreases with temperature due to the viscosity effect. When molecular flow predominates, however, the admittance remains constant with pressure and increases with increasing temperature. The apparatus, procedure, and equations used are detailed. Over the range of pressures covered, the flow is laminar for both gases and, possibly, approaches turbulent flow for nitrogen at the upper end. M.W.R.

N67-10252*# Melpar, Inc., Falls Church, Va.

PERMEABILITY MEASUREMENTS OF TWO LOW-DENSITY PHENOLIC-NYLON CHARS Final Report

P. J. Lare and H. Hahn [1966] 13 p
(Contract NAS1-2977)
(NASA-CR-66213) CFSTI: HC $1.00/MF $0.50 CSCL 11E

Permeability measurements are presented for two specimens each of two low-density phenolic-nylon chars, and observed permeation of nitrogen and helium gases through the chars are tabulated for pressure differentials from 0.5 to 3.0 psi, at 0.5 intervals. For the specimens with bulk density of 42 lb/ft^3, permeability at 1 psi is 32.0 and 37.0 through nitrogen; and 48.6 and 65.8 through helium. The specimens with bulk densities of 19 lb/ft^3 exhibit permeabilities of 85.2 and 50.4 in nitrogen, and 152 and 84.2 in helium. M.W.R.

N67-10355# Naval Air Engineering Center, Philadelphia, Pa. Aeronautical Materials Lab.
OXYGEN AGING EXPOSURE OF FINISHED AND DYED NYLON CLOTHS
W. T. Kelly 4 May 1966 19 p refs
(NAEC-AML-2445; AD-637526) CFSTI: HC $1.00/MF $0.50

Three ounce per square yard nylon cloths in greige, scoured, and dyed conditions were subjected to oxygen aging exposure of 300 psi at 158F for 96 hours. The expected 10 percent loss in breaking strength by oxygen aging was exceeded by 2 samples. Laundering produced no strength change but dry cleaning greatly increased oxygen aging strength losses. Room temperature dried perchloroethylene and toluene extracted cloths had strength losses up to 55 percent when oxygen aged. High temperature drying (250F for 1/2 hr) of a toluene extracted sample before oxygen aging eliminated the strength loss produced by toluene retention Author (TAB)

N67-10454# Naval Air Engineering Center, Philadelphia, Pa.
A STUDY OF SYNTHETIC FIBER CLOTH VARIABLES, ACCELERATED WEATHERING VARIABLES AND THEIR INTERACTION Progress Report, 16 Dec. 1965–1 Jul. 1966
Warren T. Kelly 1 Jul. 1966 24 p refs
(PR-2; AD-638300) CFSTI: HC $1.00/MF $0.50

An investigation was made to determine the effect of moisture on rate of strength deterioration from accelerated weathering and the effect that synthetic fiber cloth variables have on this deterioration. Data from XW accelerated weathering exposures of 50, 100 and 150 hours on Type 330, Type 380, and NOMEX nylon are given in this progress report. Author (TAB)

N67-10501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
GEOMETRICAL EFFECTS OF FILAMENT TWIST ON THE MODULUS AND STRENGTH OF GRAPHITE FIBER REINFORCED COMPOSITES Technical Report, Oct. 1965-Jan. 1966
James M. Whitney May 1966 18 p refs
(AFML-TR-66-131; AD-638299) CFSTI: HC $1.00/MF $0.50

Using basic theory previously appearing in the literature, equations are derived for determining the effects of yarn twist on the modulus and strength of graphite reinforced composites. In the strength analysis the variation of individual filament properties is considered. Results show that a few turns of twist per inch have little effect on either modulus or strength. However, these properties decrease in value rapidly beyond seven turns per inch. The theory was checked using data from a unidirectional composite reinforced with graphite yarns having approximately five turns of twist per inch. Since the processability of graphite filaments into a fiber reinforced composite is improved by using a twisted yarn, it seems advantageous from a geometrical standpoint to use yarns containing several turns of twist per inch Author (TAB)

N67-10503# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE EFFECT OF HIGH PRESSURE ON CRYSTALLIZATION KINETICS: FUSED SILICA
D. R. Uhlmann, J. F. Hays, and D. Turnbull Apr. 1966 39 p refs
(Contract Nonr-1866(50))
TR-6; AD-638140) CFSTI: HC $2.00/MF $0.50

A thermodynamic theory is developed for the effect of pressure on the kinetics of phase transformations. The results suggest that application of pressure may have a profound effect in increasing the rate of crystal nucleation, but that its effect on growth rate should generally be a smaller inhibitory one. Observations on SiO2 carried out in a Bridgman-anvil high pressure device demonstrated the occurrence of crystallization under conditions of temperature and pressure where none had been anticipated from the kinetic formalism. A number of hypotheses are suggested to account for the observations, the most satisfactory of which is based on the effect of water, and the possible existence of a water-rich region at the interface at high pressure, in enhancing the extent of crystallization in a given time Author (TAB)

N67-10689# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
IMPURITIES AND THEIR EFFECTS IN NUCLEAR-GRADE BERYLLIA POWDERS
K. D. Reeve Jan. 1966 18 p refs
(AAEC-TM-311)

The criteria for sinterability in high-purity beryllia powders are discussed. Of common impurities in less-pure powders, Si, Al, Ca, Mg, and Fe are considered to have the major effects on sinterability. Of these, Si and Al have detrimental effects, and Ca, Mg, and Fe beneficial effects. It is suggested that for an impure powder to be sinterable, the combined (Si+Al) content should be no higher than the combined (Ca+Mg+Fe) content. Author (NSA)

N67-10697# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
DEVELOPMENT OF CERAMIC COATINGS FOR FISSION-PRODUCT RETENTION IN CERAMIC FUELS
E. J. Ramm, P. D. Smith, and K. D. Reeve Jan. 1966 16 p refs
(AAEC-E-148)

A general discussion on glaze-type coatings for fission product retention within BeO spheres fueled with PuO_2–ThO_2 particles is presented. From these considerations, a glaze thickness of 0.004 in. was chosen as a basis for laboratory studies. Glaze development commenced with a conventional high temperature glaze; this was modified by increasing the SiO_2 content and by progressively replacing some of the SiO_2 by TiO_2, ZrO_2, TiO_2–ZrO_2, BeO and BeO plus TiO_2. Glaze structures varied from amorphous to predominantly crystalline. When applied to fueled BeO cubes, some glazes failed to cover fuel particles and others tended to react with them. It is concluded that glaze type coatings show little promise for the present applications. Author (NSA)

N67-10760*# Stanford Research Inst., Menlo Park, Calif.
POLYMERS FOR SPACECRAFT HARDWARE Monthly Technical Progress Report, 10 Sep.–9 Oct. 1966
R. F. Muraca, N. Fishman, A. A. Koch, and J. S. Whittick 15 Oct. 1966 17 p ref Prepared for JPL
(Contracts NAS7-100; JPL-950745)
(NASA-CR-79414; MTPR-28) CFSTI: HC $1.00/MF $0.50 CSCL 11A

Spacecraft environmental effects on commercial polymers were investigated. Maximum volatile condensable material and total weight loss results are tabulated for a series of protective coatings, wire enamels, seals and gaskets, and thermal coatings. The data indicates that the most popular thermal coatings for spacecraft use do not meet the suggested standards, and that almost any Viton formulation is superior to other elastomers. Details are given on the operation procedures to determine the changes in pertinent properties of polymeric materials subsequent to a

decontamination treatment, a thermal vacuum exposure, and a decontamination treatment followed by a thermal vacuum exposure. The results of the decontamination treatment on films and sheets, hardware and structural materials, seals and gaskets, and tie cords/lacing tapes are also tabulated. N.E.N.

N67-10997# Pennsylvania State Univ., University Park. Ordnance Research Lab.

THE INFLUENCE OF CONSTITUTION AND MICROSTRUCTURE ON THE TRANSVERSE STRENGTH OF A CRYSTALLIZED GLASS

R. F. Davis Washington, Navy Dept., 3 Aug. 1966 90 p refs (Contract NOw-65-0123-d)

(AD-638336) CFSTI: HC $3.00/MF $0.75

The thermal expansion behavior and abraded and unabraded transverse strengths of a glass, nucleated glass, and 15%, 30% and 50% crystalline glass-ceramic were correlated with the constitution and microstructure of these specimens. X-ray diffraction patterns revealed that the crystalline phases present were those of diopside and beta-eucryptite in varying amounts depending on the percentage of crystallization. The bulk thermal expansion coefficients of the unnucleated, nucleated, and 15% crystalline samples were of approximately the same value because they were determined primarily by the expansion characteristics of the glass or continuous glass matrix; whereas, the expansion coefficients of the 30% and 50% crystalline specimens decreased with increasing crystallinity because they were determined by (1) the positive expansion characteristics of the glass and diopside crystals and (2) the dominating negative bulk expansion coefficient of beta-eucryptite. TAB

N67-11001# Whittaker Corp., San Diego, Calif.

MICROMECHANICS–FAILURE MECHANISM STUDIES Final Technical Report, 15 Apr. 1965–15 Apr. 1966

Victor G. Grinius Wright-Patterson AFB, Ohio, AF Mater. Lab., Aug. 1966 177 p refs

(Contract AF 33(615)-1660)

(AFML-TR-66-177; AD-638921) CFSTI: HC $5.00/MF $1.00

The objective of the program was to investigate the micromechanical behavior of a fiber reinforced composite under static tension, bending, shear loading, and also under fatigue loading. The approach used for the investigation was both analytical and experimental. Material models and composite specimens including various material combinations were observed under load, evaluated photoelastically, and tested to destruction. The reasons for fracture initiation and the mode of fracture propagation are suggested. The degree of correlation between analysis and experiments is determined Author (TAB)

N67-11031# Naval Ordnance Lab., White Oak, Md.

DYNAMIC COMPRESSION TESTING OF SHOCK MITIGATING MATERIALS

James L. Rand and William M. Hinckley 9 Jan. 1966 46 p refs

(NOLTR-66-39; AD-639062) CFSTI: HC $2.00/MF $0.50

Dynamic stress strain relations have been obtained in compression at room temperature for a number of shock mitigating materials. The Hopkinson pressure bar technique has been used to obtain data at rates of strain from 370 in/in/sec to 13,750 in/in/sec. It has been observed that for many materials the effect of strain rate on stress for large values of strain can be measured to within 10 percent. Stress-strain relations which appear to be insensitive to changes in high strain rates have been observed in several materials. Experience has shown that rubber compositions cannot be tested by this method Author (TAB)

N67-11082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STABILIZATION OF TEFLEX

A. M. Peterka 6 Jun. 1966 17 p refs Transl. into ENGLISH from Chem. Zvesti (Bratislava), v. 17, 1963 p 656–665

(FTD-TT-65-1821; AD-639425) CFSTI: HC $1.00/MF $0.50

The stabilization of teflex (a poly(fluorochloroethylene) of Czechoslovakian manufacture) was checked in practice during the processing of the polymer with an extruder and casting under pressure. Especially constructed melting furnaces were used for the processing. The addition of the system bromate-nitric acid permitted the processing teflex by casting under pressure to a temperature of 300 - 340C. At that temperature the viscosity of the melt is sufficiently low, and it is possible to obtain formed pressed objects in weights of up to 120 kg. Mechanical properties of stamped objects were in all cases better than for unstabilized teflex, and dehydration of the polymer during the processing was much lower. Addition of stabilizers does not deteriorate the electrical properties of teflex, which are identical with foreign samples of polytrifluorochloroethylene Author (TAB)

N67-11098# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THERMAL STABILITY OF GLASS PLASTICS

G. A. Yakovlev 17 Jun. 1966 16 p refs Transl. into ENGLISH from the publ. "Nauchnova Soveshchaniye po Teplovym Napryazheniyam v Elementakh Konstruktsiy 4th" USSR, 1964 p 329–338

(FTD-TT-65-1916; TT-66-62343; AD-639460) CFSTI: HC $1.00/MF $0.50

Results are presented of an investigation aimed at establishing the dependence of the strength of glass-reinforced plastics on the frequency of heating–cooling cycles. Author (TAB)

N67-11133# Joint Publications Research Service, Washington, D. C.

EXPLOSIVE SUBSTANCES AND THE CONDITIONS REQUIRED FOR THEIR SAFE STORAGE

S. I. Sil'vestrovich 2 Nov. 1966 91 p refs Transl. into ENGLISH of the book "Vzryvchatyye Veshchestva i Usloviya Ikh Bezopasnogo Khraneniya" Moscow, Promstroyizdat, 1957 p 1–102

(JPRS-38457; TT-66-34883) CFSTI: $1.00

The recent knowledge concerning the destructive action of explosives is discussed and related problems connected with safe storage of explosives and, the steps that must be taken to provide safety for the storerooms and the neighborhood are described. This book also contains comparative data on the most important types of explosives, the methods used for their explosion, their fields of application, the properties which govern their safety in storage and, accordingly, the conditions and rules for safe storage of explosives in storerooms. Author

N67-11164# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HYDROPHOBIZED POWDERS FOR FILLING POLYETHER AND EPOXY RESINS

O. O. Pashchenko and R. V. Serbina 28 Jun. 1966 8 p Transl. into ENGLISH from Khimichna Promyslovist' (USSR), no. 4, 1964 p 7–8

(FTD-HT-66-78; TT-66-62354; AD-639492) CFSTI: HC $1.00/MF $0.50

The modification of mineral fillers with polyethyl hydrosiloxane is reported. A description is given of a method for preparing such fillers, and of their effects on the properties of polyether and epoxy plastics. TAB

N67-11170# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE APPLICATION OF HEAT-INSULATION HONEYCOMB PLASTIC (SOTOPLAST)

B. V. Lifanov 21 Jun. 1966 8 p Transl. into ENGLISH from Kholodiz. Tekhn. (Moscow), no. 3, 1964 p 45–47
(FTD-HT-66-248; TT-66-62320; AD-639341) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: the application of heat-insulation honeycomb plastic (sotoplast). TAB

N67-11172# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMERS WITH METAL PROPERTIES
31 Aug. 1966 4 p Transl. into ENGLISH from Ekon. Gaz. (Moscow), no. 33, 18 Aug. 1965 p 38
(FTD-HT-66-342; TT-66-62237; AD-638898) CFSTI: HC $1.00/MF $0.50

This thin elastic layer is provided with wonderful properties: it reliably protects against the action of X-rays. Chemists introduced into polyethylene the finest lead particles and in this attributed to it new qualities. Investigators created many hybrides—polymeric substances, containing metal additions. From polystyrene, copper, caprone and cadmium, and also from other materials they synthesized complex substances, possessing greater thermal stability, high strength electro-conductivity, and physical and chemical properties. When creating such hybrides the scientists of the Institute of General and Inorganic Chemistry of the Academy of Sciences UKR-SSR utilize chemical reactions, high temperature and even electrical current. A special apparatus was developed for this. The new materials are recommended by the scientists for application in intrament construction, electrical technology, and chemical industry. Document quoted in its entirety. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N67-10070# Belgian Royal Observatory, Uccle.
COMPARISON OF FORMS OF THE ELASTIC EQUATIONS FOR THE EARTH
Harold Jeffreys (Cambridge Univ.) and R. O. Vicente (Lisbon Univ.) 1966 32 p refs Repr. of Verhandel. Koninkl. Vlaam. Acad. Wetenschap. Belf., Kl. Wetenschap. (Brussels), v. 37, no. 3 *Its* Ser. Geophys. No. 72
CFSTI: HC $2.00/MF $0.50

The equations for the bodily tide and free oscillations have been derived in at least four different ways, and expressed in different forms, and the numerical results for Love's numbers differ by about 1 part in 20. The paper attempts to trace the reasons for the differences. The main results are as follows: The equations of motion derived by various authors are equivalent. Some doubt is cast on the conditions at the centre adopted in some numerical integrations, and a set is given that should at least give more rapid convergence. The differences for different Earth models and for the comparison of statical and semidiurnal tides are of the order of ten times what are likely if the models are to preserve the mean density and the transit times of S. The effect of a surface layer is estimated for a simple model, in which the properties of the interior are kept constant but those of the crust are varied. This direct effect is smaller than that calculated, and has the opposite sign. If the properties of the interior are also varied to keep the mean density and the travel times the same the changes nearly cancel. Author

N67-10071# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SOLUTION OF THE CAUCHY PROBLEM FOR THE LAME EQUATION WITH THE AID OF THE BIWAVE EQUATION
I. S. Arzhanykh and R. Nazarov [1964] 2 p ref Transl. into ENGLISH from Izv. Akad. Nauk Uz. SSR, Ser. Fiz. Mat. Nauk (Tashkent), v. 8, no. 6, 1964 p 84–85
CFSTI: HC $1.00/MF $0.50

A vector determination is made, and partial differential equations for the initial conditions are derived. The Cauchy problem is then solved for the biwave equation with the initial conditions, leading to the Lame equation. K.W.

N67-10087# Brazil Univ., Rio de Janeiro. Inst. of Pure and Applied Mathematics.
OBSTRUCTION THEORY
Edwin H. Spanier 1966 62 p refs Notas Math. No. 34
CFSTI: HC $3.00/MF $0.50

Consideration is given to obstruction theory emphasizing the study of factoring general relative lifting problems into simpler problems. Each of these simpler problems is assumed to be solvable by algebraic means, and the successive obstructions are the algebraic measures of the non-solvability of the associated lifting problems at successive stages. Maps are factorized as infinite composites, and this factorization is shown to yield an infinite sequence of obstructions. The study is introduced by the classification of maps into a space with one non-trivial homotopy group. This leads to a solution of the relative lifting problem involving fibrations whose fiber has exactly one non-trivial homotopy group. It is proved that a large class of maps can be factored into infinite composites of such fibrations, and the results are applied to some specific cases. C.T.C.

N67-10200*# National Aeronautics and Space Administration, Washington, D. C.
SMALL DENOMINATORS. I: CONCERNING THE PRESENTATION OF A CIRCLE [MALYYE ZNAMENATELI. I. OB OTOBRAZHENIYAKH OKRUZHNOSTI NA SEBYA]
V. N. Arnol'd [1961] 91 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Mat. (Moscow), v. 25, 1961 p 21–86
(NASA-TT-F-9827) CFSTI: HC $2.50/MF $0.75 CSCL 12A

It was shown in the first part of this book that the analytical transformation of a circle, which differs little from a turn, whose number of rotations is irrational and which satisfies certain arithmetical requirements, can be converted to a turn by an analytical change of variable. Discussed in the second part is the space of circle representations and the place occupied in that space by various types of representations. References are made in the appendices to the investigation of trajectories on a torus and to Dirichlet's problem for the equation of a vibrating string. Author

N67-10229*# National Aeronautics and Space Administration, Washington, D. C.
FORMULATION OF SOLUTIONS FOR LINEAR DIFFERENTIAL EQUATIONS WITH QUASI PERIODIC COEFFICIENTS BY MEANS OF THE ACCELERATED CONVERGENCE METHOD [O POSTROYENII RESHENIY LINEYNYKH DIFFERENTSIAL'NYKH URAVNENIY S KVAZI-PERIODICHESKIMI KOEFFITSIYENTAMI S POMOSHCH'YU METODA USKORENNOY SKHODIMOSTI]
Yu. A. Mitropol'skiy and A. M. Samoylenko Oct. 1966 27 p refs Transl. into ENGLISH from Ukr. Mat. Zh. (Kiev), v. 17, no. 6, 1965 p 42–59
(NASA-TT-F-10370) CFSTI: HC $2.00/MF $0.50 CSCL 12A

The system of n differential equations $\frac{dx}{dt} = [A + P(\omega t)]x$ where A is a constant matrix, and $P(\omega t)$ is a matrix having n basic frequencies is investigated. For the solution, a correction matrix, ξ, is introduced and the solution is obtained in the form $x = \Phi(\omega t)e^{At}x_0$ where Φ is a periodic matrix of period 2π. Author

N67-10285# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELEMENTS OF COMPUTER MATHEMATICS
V. S. Mikhel'son 11 Apr. 1966 292 p Transl. into ENGLISH of the book "Elementy Vychislentel'noy Matemati-ki" Moscow, Gos. Izd. "Vysshaya Shkola", 1962 p 1–270
(FTD-MT-64-290; TT-66-62123; AD-637478) CFSTI: HC $6.00/MF $1.50

Contents: Small Computers with Odner Wheels; Small Calculating Machines with Stepped Shafts; Small Calculating Machines with Proportional Levers; Certain Rational Methods of the Work on Small Computers; The Classification of Small Calculating Machines; Computing-Perforation Machines; From the History of the Development of Calculating Machines and Instruments; Determinants and Systems of Linear Algebraic Equations; The Calculation of Determinants and the Solution of Systems of Linear Algebraic Equations with the Help of Small Computers; Method of Approximation for the Solution of Equations with one Unknown; The Presentation of Numbers and Commands in Electronic Computers; The Operating Principle of Electronic Computers; Examples of Programming of Electronic Computers. TAB

N67-10293# Information Research Associates, Inc., Lexington, Mass.
ON SELECTING VARIABLES IN SUCCESSION FOR BEST DISCRIMINATION
Poduri S. R. S. Rao 22 Aug. 1966 9 p ref
(Contract Nonr-4752(00))
(TN-4; Rept.-100:9; AD-638493) CFSTI: HC $1.00/MF $0.50

When several variates are available to classify the individual into either of two (or more) populations, the usual practice is to construct a linear discriminant function with all the variates and reject the variates with low discriminating power. Clearly this method involves extra computations and cost. A method is suggested of selecting the variates in succession for best discrimination, when the correlation between any pair of variates is the same. Author (TAB)

N67-10296# Wisconsin Univ., Madison. Mathematics Research Center.
ESTIMATION OF CAPACITY WITH BOUNDS FOR THE ERROR, I
J. Barkley Rosser Apr. 1966 11 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-645; AD-638658) CFSTI: HC $1.00/MF $0.50

It is known that for many types of solid figures the electrostatic capacity is equal to the value, at a suitable interior point of a related solid, of a function which is harmonic inside the second figure and attains specified values on its surface. To estimate this value, one attempts to approximate the desired harmonic function by a linear combination of known harmonic functions. If the linear combination is chosen so as to approximate closely the specified values on the surface, then it will approximate interior values at least as closely. The determination of a suitable linear combination can be reduced to a linear programming problem of a familiar type. In this preliminary report, the main features of the method are illustrated for the well studied problem of the capacity of a cube Author (TAB)

N67-10303# Washington Univ., Seattle. Dept. of Mathematics.
GRAPH THEORY STUDY Final Report, 1 Sep. 1965–31 Aug. 1966
Micha A. Perles 31 Aug. 1966 10 p
(Grant Nonr(G)-00013-66)
(AD-638019) CFSTI: HC $1.00/MF $0.50

The use of Gale transforms and Gale diagrams for examining convex polytopes is described. An exact formula for the number of different combinatorial types of simplicial d-polytopes with d+3 vertices, and an asymptotic estimate for the number of all combinatorial types of d-polytopes with d+3 vertices, were obtained. A discussion of rational and irrational polytopes is given. Other work concerning problems in the theory of convex polytopes is also discussed. L.S.

N67-10306# Conneticut Univ., Storrs. Dept. of Statistics.
FEASIBILITY STUDY ON THE DETERMINATION OF REGIONS OF ROBUSTNESS IN THE PEARSON SYSTEM BY MONTE CARLO TECHNIQUES
Donald Fridshal and Harry O. Posten Jul. 1966 24 p
(Contract Nonr-3292(03))
(RR-23; AD-638636) CFSTI: HC $1.00/MF $0.50

The feasibility of determining regions of robustness of the t-test (with respect to deviations from normality within the Pearson system) by Monte Carlo techniques is investigated. A computer program for this purpose has been written and run using a high-speed digital computer. This study evaluates the quantity of computer time required to perform a large scale Monte Carlo study for both the single-sample and two-sample t-test problems. A detailed description of the evaluation is presented and estimates of the pertinent computer times are given Author (TAB)

N67-10315# Syracuse Univ., N. Y.
ENGINEERING APPLICATIONS OF FUNCTION SPACE CONCEPTS TO SIGNALS AND SYSTEMS. PART I: FINITE DIMENSIONAL SPACES
F. M. Reza Griffiss AFB, N. Y., RADC, Aug. 1966 99 p
(Contract AF 30(602)-3853)
(RADC-TR-65-399; AD-638633) CFSTI: HC $3.00/MF $0.75

This report deals with those aspects of modern mathematics which form the foundation for any problems of the representation and processing of finite signals and systems. Chapter I is primarily concerned with an expositionary review of the problem of representation in a finite-dimensional space. The linear and quadratic forms (cost functions) associated with the elements of a vector space comprise the main theme of the second chapter. The third chapter deals with the theory of linear operators; that is, the linear processing of finite data. The familiar Euclidean real and complex spaces are treated in Chapter IV. Throughout the report, the author emphasized those aspects of the theory which appeared to be an indispensable tool for engineers and scientists. No previous knowledge beyond the undergraduate engineering courses is assumed. A good number of examples are included. Specific applications to electrical systems, communications and control theory will be undertaken in a subsequent report. TAB

N67-10330# Wisconsin Univ., Madison. Mathematics Research Center.
COMPLEX NUMBER AND OTHER EXTENSIONS TO THE CLIFFORD ALGEBRA WITH AN APPLICATION TO THE THEORY OF CONTINUED FRACTIONS
P. Wynn May 1966 50 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-646; AD-638624) CFSTI: HC $2.00/MF $0.50

An isomorphism between vectors whose components are complex numbers and square matrices having a certain structure is established. This isomorphism is such that the sum and difference of two vectors correspond to the sum and difference of the equivalent matrices; furthermore the inverse of a vector (this is described in the text) corresponds to the inverse of its equivalent matrix. This isomorphism is first extended so as to concern vectors whose components are quaternions, and then still further generalized to deal with what are called hyper-quaternion vectors. The isomorphism is then applied to the investigation of certain matrix continued fractions: the resulting theory establishes the existence of the vector-valued ade table. Author (TAB)

N67-10333# Wisconsin Univ., Madison. Mathematics Research Center.
COMPUTER ANALYSIS OF THREE-FACTOR INTERACTIONS IN CONTINGENCY TABLES
Marvin A. Kastenbaum and Dennis Kuba Apr. 1966 53 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-636; AD-638662) CFSTI: HC $3.00/MF $0.50

Numerous methods have been proposed for testing the hypothesis of zero three-factor interaction in contingency tables. These methods are incorporated into a single computer program which is designed to calculate the test statistic by any or all of the proposed techniques, and which also provides estimators of the interactions and corresponding two-sided confidence intervals. The program is written in Fortran 63 for the CDC-3600 computer, and will analyze interactions in contingency tables of dimensions $2 < R < 5$, $2 < S < 5$, $2 < T < 16$, for $R < S < T$. Author (TAB)

N67-10336# Stanford Univ., Calif. Dept. of Statistics.
ASYMPTOTIC EXPANSIONS AND LARGE DEVIATIONS IN MANY DIMENSIONS
Michael Woodroofe 15 Aug. 1966 29 p refs
(Contract Nonr-225(52))
(TR-118; AD-63817) CFSTI: HC $2.00/MF $0.50

Let $\{X^{(n,k)}; k = i,\ldots,k_n,\ n = 1,2,\ldots\}$ be a triangular array of independent, indentically distributed, p-dimensional random vectors and let $S^{(n)} = X^{(n,1)} + \ldots X^{(n,k_n)}$. (1) An asymptotic expansion for the distribution function of $k_n^{-1/2} S_n$ is given which is valid under regularity conditions which are the natural analogues of those required in the one-dimensional case. For a wide class of vectors $\mu = (\mu_1,\ldots,\mu_n)'$, $\Pr\{k_n^{-1/2} S_i^{(n)} \geq \lambda_n \mu_i,\ i = 1,\ldots,p\}$ is estimated under the assumptions that $|X^{(n,1)}| \leq A_n$ w.p. one and $\lambda_n^2 9 A_n^2 = o(k_n)$ as $n \to \infty$ where $q = \max(3,p)$. It is shown that by using truncation the assumption that of boundedness may be dropped. Author

N67-10371# Wisconsin Univ., Madison. Mathematics Research Center.
A NUMERICAL METHOD FOR THE EXTERIOR DIRICHLET PROBLEM FOR THE REDUCED WAVE EQUATION
Donald Greenspan and Peter Werner Apr. 1966 52 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-633; AD-638611) CFSTI: HC $3.00/MF $0.50

A digital computer technique for approximating the solution of the exterior Dirichlet problem for the reduced wave equation is described and discussed. Author (TAB)

N67-10379# RAND Corp., Santa Monica, Calif.
NUMERICAL METHODS FOR INVERTING POSITIVE DEFINITE MATRICES
R. J. Clasen Aug. 1966 56 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4952-PR; AD-637930) CFSTI: HC $3.00/MF $0.50

An explanation of four methods for inverting positive definite matrices: the Gauss-Jordan and bordering methods, the square root procedure, and the Choleski method. The theory of positive definite matrices is summarized, and main applications of the matrices are discussed. A comparison of the accuracy of the inversion techniques is also made. Major conclusions are that matrices in many applications can be shown to be positive definite or partitionable into definite submatrices and, hence, can be inverted by means of special algorithms; and that Choleski's method is faster and seems at least as accurate as the more common methods for solving simultaneous equations. Author (TAB)

N67-10398# Joint Publications Research Service, Washington, D. C.
MATHEMATICS AND SEMANTICS
L. A. Rvachev 17 Oct. 1966 55 p Transl. into ENGLISH of the book "Matematika i Semantika" Kiev, Naukova Dumka Publishing House, 1966 p 1–78
(JPRS-38190; TT-66-34617) CFSTI: $3.00

The feasibility of the nominalistic interpretation of mathematics is analyzed. S.C.W.

N67-10403# Wisconsin Univ., Madison. Mathematics Research Center.
REDUCTION OF A MATRIX WITH POSITIVE ELEMENTS TO A DOUBLY STOCHASTIC MATRIX
M. V. Menon May 1966 10 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-658; AD-638654) CFSTI: HC $1.00/MF $0.50

Every positive matrix is shown to be diagonally equivalent to one with prescribed, consistent, row and column sums. Author (TAB)

N67-10409# Wisconsin Univ., Madison. Mathematics Research Center.
ON SPLINE FUNCTIONS
I. J. Schoenberg May 1956 55 p refs Suppl. included
(Contract DA-11-022-ORD-2059)
(MRC-TSR-625; AD-638656) CFSTI: HC $3.00/MF $0.50

It is shown how spline functions allow one to generalize the Bernstein polynomials, thereby also leading to variation diminishing approximation methods which converge faster than the Berstein polynomials. Author (TAB)

N67-10460# Michigan State Univ., East Lansing. Dept. of Statistics.
A PROPERTY OF THE LOG-LIKELIGOOD-RATIO PROCESS FOR GAUSSIAN PROCESSES
B. L. S. Prakasa Rao and Herman Rubin 23 Aug. 1966 9 p
(Contract Nonr-2587(02))
(RM-168; TR-11; AD-637793) CFSTI: HC $1.00/MF $0.50

The aim is to give a necessary and sufficient condition for a Gaussian process to be the log-likelihood-ratio process of Gaussian processes. All the measures encountered are assumed to be mutually absolutely continuous Author (TAB)

N67-10461# Brazil Univ., Rio de Janeiro. Inst. of Pure and Applied Mathematics.
TEMPORALLY INHOMOGENEOUS NON LINEAR WAVE EQUATIONS IN HILBERT SPACES
Luiz Adauto Medeiros 1965 82 p refs *Its* Notas de Math. No. 31
CFSTI: HC $3.00/MF $0.75

The Cauchy initial value problem was generalized and extended to the case of wave equations with time variable coefficients. Perturbation equations were introduced into the coefficients and the system was then considered a first order nonlinear equation in a Hilbert space. G.G.

N67-10481# Stanford Univ., Calif. Dept. of Statistics.
BAYES SEQUENTIAL STRATEGIES FOR CROSSING A FIELD CONTAINING ABSORPTION POINTS
Shelemyahu Zacks 8 Aug. 1966 27 p refs
(Contract Nonr-225(52))
(TR-117; AD-638616) CFSTI: HC $2.00/MF $0.50

A sequential decision problem is considered in which N particles have to cross a given field. Two alternative crossing paths are available. An unknown number of absorption points J sub 1 and J sub 2 are planted at each of the crossing paths. The bivariate prior distribution of (J sub 1, J sub 2) is given. If a particle passes close to an absorption point it may survive with probability s, $0 < s < 1$. If a particle is absorbed, both the particle and the absorption point are ruined. There is no replacement

of ruined absorption points. All absorption points act independently. The particles cross the field in a consecutive order, and a crossing path can be chosen for each particle. The objective is to maximize the expected number of survivors. The Bayes sequential procedure is characterized. The conditions under which the Bayes strategy is determined by the maximal posterior survival probabilities are specified. Author (TAB)

N67-10489# Wisconsin Univ., Madison. Mathematics Research Center.
ON CEBYSEV'S METHOD FOR FUNCTIONAL EQUATIONS
M. I. Necepurenko Mar. 1966 18 p refs Transl. into ENGLISH from Usp. Mat. Nauk (Moscow), v. 9, no. 2, 1954 p 163–170
(Contract DA-11-022-ORD-2059)
(MRC-TSR-648; AD-638626) CFSTI: HC $1.00/MF $0.50

Sufficient conditions are given for the cubic convergence of Cebysevs iterative method for the solution of nonlinear operator equations in a Banach space. Applications are given to nonlinear ordinary differential equations. Author (TAB)

N67-10509# Wisconsin Univ., Madison. Mathematics Research Center.
THE APPROXIMATE SOLUTION OF FREDHOLM INTEGRAL EQUATIONS OF FIRST KIND
I. N. Dombrovskaja Apr. 1966 14 p refs Transl. into ENGLISH from Ural. Gos. Univ. Mat. Zap. (USSR), v. 4, no. 4, 1964 p 30–35
(Contract DA-11-022-ORD-2059)
(MRC-TSR-652; AD-638627) CFSTI: HC $1.00/MF $0.50

A numerical method for approximating the quasi-solution is developed based on solving finite systems of equations in finite-dimensional subsets M sub n of M. Convergence of the approximations obtained in this fashion to the quasi-solution is proved. Author (TAB)

N67-10514# Wisconsin Univ., Madison. Mathematics Research Center.
ON HERMITE-BIRKHOFF INTERPOLATION
I. J. Schoenberg May 1966 11 p refs
(Contract DA-11-022-ORD-2059)
(MRC-TSR-659; AD-638682) CFSTI: HC $1.00/MF $0.50

A theorem of Polya (1931) concerning the existence of a unique polynomial solution to an interpolation problem of the kind studied by G. D. Birkhoff (1906) is generalized from Polya's case of only two nodes to a more general type of interpolation problem here described as of the quasi-Hermite type. Author (TAB)

N67-10517# Wisconsin Univ., Madison. Mathematics Research Center.
ON SOME ITERATIVE PROCESSES
R. A. Safiev Mar. 1966 13 p refs Transl. into ENGLISH from Zh.Vychislitel'noi Mat. i Mat. Fiz. (Moscow), no. 4, 1964 p 139–143
(Contract DA-11-022-ORD-2059)
(MRC-TSR-649; TT-66-62192; AD-638615) CFSTI: HC $1.00/MF $0.50

The paper presents a unified treatment of the convergence of two higher-order iterative methods for solving the nonlinear equation P(x) = 0 in a Banach space. Both methods use the second derivative of the operator P, and have a cubic rate of convergence under given conditions. One method is known as the method of tangent hyperbolas, as generalized by M. A. Mertvecova, and the other method is the generalization of Cebysevs method given by N. I. Necepurenko. Author (TAB)

N67-10520# Texas A&M Research Foundation, College Station.
SIMULATION OF PERT PROJECT COMPLETION TIMES BY STRATIFIED SAMPLING METHODS Technical Report No. 3
Larry J. Ringer [1966] 11 p refs
(Contract DA-31-124-ARO(D)-282)
(AROD-4721-4; AD-637830) CFSTI: HC $1.00/MF $0.50

The algorithms for computing the cumulative distribution of the completion times of PERT networks proposed by Hartley and Worthan (AD-626 486) and Ringer (AD-630 841) will in general only reduce the original network to a network with fewer activities. The c.d.f. of the project completion time for the reduced network will then be computed by some other method, such as Monte Carlo simulation. In this note sampling schemes for estimating this c.d.f. are discussed. A completely random sampling scheme and a sampling procedure based on stratification of activity completion times are described and compared. Author (TAB)

N67-10576# Belgian Royal Observatory, Uccle.
SOME CONSIDERATIONS ON THE SOLUTION OF THE PROBLEM OF INDIRECT MEASUREMENTS OF LINKED MAGNITUDES [QUELQUES CONSIDERATIONS SUR LA RESOLUTION DU PROBLEME DES MESURES INDIRECTES DE GRANDEURS LIEES]
J. Dommanget 1966 11 p refs In FRENCH *Its* Commun., Ser. B, No. 7
(NT-147) CFSTI: HC $1.00/MF $0.50

A mathematical discussion on indirect measurements of bound magnitudes is presented. Expressions are derived for the usual methods of solution: the elimination of dependent unknowns, and the indeterminate Lagrange coefficients. Considered a more practical solution, the direct method by successive approximations is recommended since it reduces to a minimum the order of inverse Cracovians, and the calculation of errors offers no difficulty. Transl. by R.Ll.

N67-10869*# Pennsylvania State Univ., University Park.
DIFFERENTIAL OPERATORS AND THEIR ADJOINTS UNDER INTEGRAL AND MULTIPLE POINT BOUNDARY CONDITIONS
Alan M. Krall [1965] 16 p refs
(Grant NGR-39-009-041)
(NASA-CR-79713) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Developments in the area of linear matrix differential systems under various boundary, or auxiliary, conditions are briefly reviewed, and it is pointed out that in each case an adjoint system was defined, which was usually motivated by the properties of the Green's matrix of the original system. The use of Hilbert space setting for deriving adjoint systems, in systems which cannot be defined by a Green's matrix, is also considered. It is shown that the adjoint system in a Hilbert space is the one defined by using Green's matrices. Adjoint systems were also derived when no Green's matrix exists. L.E.W.

N67-10870*# General Precision, Inc., Little Falls, N. J.
A TECHNIQUE OF QUASI-OPTIMUM CONTROL
Bernard Friedland 1965 11 p refs
(Contract NAS2-2648)
(NASA-CR-79714) CSCL 12A

The application of modern control theory to practical problems is limited by the necessity of realizing the solution of a two point boundary value problem in real time. A technique for applying this theory is described, in which no assumptions regarding the nature of the performance criterion are made and the computation of a nominal trajectory is not required. The six steps employed in using the technique are outlined in detail, and the limitations of the method are pointed out. H.S.W.

N67-10875*# Kent State Univ., Ohio. Dept. of Mathematics.
COMMENTS ON THE MARTINGALE CONVERGENCE THEOREM Technical Report No. 21

S. D. Chatterji Oct. 1966 9 p refs Submitted for publication
(Grant NsG-568)
(NASA-CR-79719) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Proofs are given for three statements made concerning convergence theorems for martingales. It is shown that these theorems are valid for all martingales. H.S.W.

N67-10889*# Pittsburgh Univ., Pa. Engineering Research Div.
STABILITY OF SOLUTIONS TO PARTIAL DIFFERENTIAL EQUATIONS Semiannual Status Report, May 1–Oct. 31, 1966
William G. Vogt 1 Nov. 1966 9 p refs
(Grant NGR-39-011-039)
(NASA-CR-79707) CFSTI: HC $1.00/MF $0.50 CSCL 12A

Research effort focussed on examining the technical literature to determine the status of results in three areas: (1) general properties of solutions to partial differential equations; (2) results on stability of solutions to partial differential equations; and (3) possible techniques for studying stability of solutions to partial differential equations. Preliminary results and conclusions, based on this survey, are listed. M.G.J.

N67-10940# Illinois Univ., Urbana. Coordinated Science Lab.
WEIGHT DISTRIBUTIONS OF BOSE–CHAUDHURI–HOCQUENGHEM CODES
Tadao Kasami Aug. 1966 36 p refs
(Contracts DA-28-043-AMC-00073(E); AF 19(628)-4379; Grant NSF GK-690)
(R-317; AD-639616) CFSTI: HC $2.00/MF $0.50

Several techniques useful for finding weight distributions of the binary Bose–Chaudhuri–Hocquenghem codes (the BCH codes) of length 2^m-1 and some other cyclic codes are presented. By using a relation between the BCH codes and the Reed–Muller codes, the invariant property of the BCH codes under a doubly transitive group of permutations on digit positions, and the power moment indentities, explicit weight distributions formulas are derived for certain BCH codes. Author

N67-10941# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
METHOD OF APPROXIMATE SOLUTION OF SYSTEMS OF NONLINEAR EQUATIONS
V. A. Matveev 24 Jun. 1966 20 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), v. 4, No. 6, 1964 p 983–994
(Contract NOw-62-0604-c)
(TG-230-T483; TT-66-62147; AD-637996) CFSTI: HC $1.00/MF $0.50

The method of steepest descent is applied to the solution of systems of nonlinear equations when the approximate values of the desired solutions of these systems are unknown. TAB

N67-10948# Wisconisn Univ., Madison. Mathematics Research Center.
THE NUMBER H_n OF IDEMPOTENT ELEMENTS IN THE SYMMETRIC SEMIGROUP ON n ELEMENTS AND THE ASYMPTOTIC EXPANSION OF H_n
Bernard Harris and Lowell Schoenfeld Feb. 1966 36 p refs
(Contract DA-11-022. ORD-2059)
(MRC-607; AD-638655) CFSTI: HC $2.00/MF $0.50

The paper counts the number of idempotent elements H sub *n* in the symmetric semigroup. The exponential generating function of H sub *n* is obtained and a number of combinatorial identities and congruences are also given. The asymptotic expansion of H sub *n* is obtained Author (TAB)

N67-10947# Michigan Univ., Ann Arbor. Coll. of Literature, Science, and the Arts.
HOMORPHISMS OF GRAPHS AND AUTOMATA
Stephen T. Hedetniemi Jul. 1966 93 p refs
(Contract Nonr-1224(21); Grant DA-ARO(D)-31-124-G665)
(Rept.-03105-44-T; AD-637000) CFSTI: HC $3.00/MF $0.75

A homomorphism of a graph G onto a graph G' is a function phi from the set of points of G onto the set of points of G' such that whenever two points A and B are adjacent in G, their images, A phi and B phi are adjacent in G'. The concept of a homomorphism of an algebra or of a relational system has been defined and studied for many years, yet the concept of a homomorphism of a graph has not. Although several definitions of graphical homomorphisms have appeared in the literature, not many results have been obtained. In this paper the concept of a homomorphism of a graph is extensively studied. It is shown that the language of graphical homomorphisms is capable of expressing a variety of previously established results in graph theory in such a light as to enable these results to be generalized, proved as corollaries, or proved more simply. It is shown that the concept of a homomorphism of a graph is related to several other concepts in graph theory on the basis of which a number of altogether new results are established. It is also shown that in some cases the usefulness of homomorphisms in solving problems in graph theory is rather limited. The results that are obtained and the questions that are raised in this paper can be said to be either algebraic or graph theoretic in nature. However, an emphasis is placed upon obtaining graph-theoretic results. Consequently, there are very few purely algebraic results in this paper; the portions of this work which are algebraic are almost entirely foundational in nature. Author (TAB)

N67-10952# RAND Corp., Santa Monica, Calif.
DISCRETE COMPOUND POISSON PROCESSES AND TABLES OF THE GEOMETRIC POISSON DISTRIBUTION
Craig C. Sherbrooke Jul. 1966 58 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4831-PR; AD-637591) CFSTI: HC $3.00/MF $0.75

A concise summary of the salient properties of discrete Poisson processes, with emphasis on comparing the geometric and logarithmic Poisson processes. The geometric Poisson process is particularly convenient when the analyst is interested in a simple model for the time between events--as in simulation. The logarithmic Poisson process is more convenient in analytical models in which the state probabilities are required. State probabilities of the geometric Poisson process are given for 176 sets of parameter values. New discrete compound Poisson processes are also introduced. These processes have properties that are particularly relevant when the summation of several different Poisson processes is to be analyzed. This study provides the theoretical foundation for extending RANDS base stockage policy for recoverable items to more than one echelon (depot and base). To make the extension computationally feasible, the logarithmic Poisson description of demand was substituted for the geometric Poisson assumption used previously Author (TAB)

N67-10955# Harvard Univ., Cambridge, Mass. Cruft Lab.
OPTIMIZATION OF STOCHASTIC FINITE STATE SYSTEMS
R. L. Kashyap 20 Apr. 1966 33 p refs
(Contract Nonr-1866(16))
(TR-599; AD-639301) CFSTI: HC $2.00/MF $0.50

The paper is concerned with the determination of optimal policy under specified performance criteria for finite state systems, i.e., systems whose allowable state space consists only of a finite number of points. It was assumed that the state transitions occur at discrete instants of time t = 0,1,2..t sub f. Moreover the attention is focused on stochastic finite state systems i.e., systems in which the state transitions are governed probabilistically by the given input. These systems are more amenable for simulation by digital computer than continuous state systems and have found application in various branches like learning theory, pursuit problems, time-sharing computer systems, the latter of which will be discussed later in the paper. The basic problem is to specify the input to the system at each instant so that the expected value of the sum

of the cost of the system in the terminal state and the cost suffered by the system during the transition is minimized. Since the number of available inputs to the system is finite, the variational theory cannot be applied directly to the solution of such problems. Some of these problems, in which the state of the system at each instant can be measured exactly, have been analyzed with the aid of dynamic programming by a number of investigators like Bellman, Howard, Zadeh, and Eaton etc. The author rephrases and solves a large class of problems, including those in which the state of the system cannot be measured exactly, with the aid of discrete maximum principle. TAB

N67-11007# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
STOCHASTIC DIFFERENTIAL GAMES WITH CONTROLLABLE STATISTICAL PARAMETERS
Jason Speyer May 1966 17 p refs
(Contract Nonr-1866(16))
(TR-501; AD-638139) CFSTI: HC $1.00/MF $0.50

A differential game is formulated where the opponents are a missile and a radar. The problem is formulated so that linear theory can be used in finding the optimal strategies of both opponents. The missile uses a mixed strategy by adding white noise into its controller. The statistics of this noise (the covariance completely describes the noise) can be controlled. In finding the optimal strategy for the covariance of the controller noise the solution by means of the calculus of variations involves a singular arc Author (TAB)

N67-11012# Northwestern Univ., Evanston, Ill.
ON NEWTON'S METHOD FOR THE SOLUTION OF SYSTEMS OF EQUATIONS
Adi Ben-Israel Aug. 1965 18 p refs
(Contract Nonr -1228(10); DA-31-124-ARO(D)-322)
(AD-639464) CFSTI: HC $1.00/MF $0.50

Newton's method for solving systems of equations is extended to rectangular systems and singular Jacobians by using generalized inverses Author (TAB)

N67-11036# Kansas Univ., Lawrence. Dept. of Mathematics.
ON NON-LINEAR ORDINARY AND EVOLUTION EQUATIONS
Haruo Murakami Jun. 1966 19 p refs
(Contract Nonr-385(13); Grant NSF G-17057)
(TR-9; AD-639398) CFSTI: HC $1.00/MF $0.50

Consideration is given to the existence and uniqueness of mild solutions of the ordinary differential equation $du/dt = f(t,u)$ and the evolution equation $du/dt = A(t)u + f(t,u)$. In these equations the unknown function $u(t)$ takes values in a Hilbert space, and $[A(t)]$ are densely defined closed linear operators of hyperbolic type. An approximate solution is found for the differential equation by a family of suitable piecewise smooth curves. C.T.C.

N67-11043# Parke Mathematical Labs., Inc., Carlisle, Mass.
GENERALIZATION OF TESTS FOR CERTAIN PROPERTIES OF CODES Interim Scientific Report
William E. Hartnett Jun. 1966 48 p refs
(Contract AF 19(628)-3826)
(ISR-7; AFCRL-66-441; AD-638338) CFSTI: HC $2.00/MF $0.50

Constructive tests for error-correcting ability, decodability, and synchronizability for variable-length codes over noisy channels are given which generalize the known Sardinas-Patterson and Levenshtein tests. Special emphasis is given to the case of indexed codes defined in terms of distance functions which generalize Hamming distance Author (TAB)

N67-11048# California Univ., Los Angeles.
[ENUMERATION OF LATIN SQUARES AND ISOMORPHISM DETECTION IN FINITE PLANES]
John Wesley Brown (Ph.D. Thesis) [1966] 63 p refs
(Contract Nonr-233(76))
(R-66-3; AD-639307) CFSTI: HC $3.00/MF $0.50

In Chapter I, various necessary conditions for isomorphism between latin rectangles are developed by treating the rectangles as sets of permutations, and studying the cycle structure of the permutations. An enumeration procedure for latin squares, which operates by forming successively higher order rectangle representatives, is then given, and the theory is applied to latin squares of order 8, yielding 1,676,257 representative squares. Chapter II details a reversible process for obtaining a complete set of orthogonal squares from a finite projective plane of the same order, and an algorithm for determining when two projective planes, in orthogonal squares form, are isomorphic is then given. The algorithm operates by constructing a minimal set of orthogonal sets for each known plane, and testing some one orthogonal set from a prospective new plane against them. Chapter III discusses known methods of generating projective planes of order n from latin squares of order n−1 Author (TAB)

N67-11053# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN APPLICATION OF AN ANALOG COMPUTER TO SOLVE THE TWO-POINT BOUNDARY-VALUE PROBLEM FOR A FOURTH ORDER OPTIMAL CONTROL PROBLEM
Vincent James Darcy (M.S. Thesis) Jun. 1966 65 p refs
(GGC/EE/66-7; AD-639578) CFSTI: HC $3.00/MF $0.75

The application of Pontryagins Maximum Principle to trajectory optimization problems results in a two-point boundary-value problem. An analog computer is used in conjunction with a human operator who has a display of the phase planes of the admissible trajectories. The human operator, having a general knowledge of the behavior of the system, adjusts control law parameters until the boundary conditions of the system are satisfied. This technique was applied to a time-optimal rendezvous with bounds on rocket thrust and fuel available and demonstrated that accurate analog computer solutions are possible Author (TAB)

N67-11066# Army Electronics Labs., Fort Monmouth, N. J.
SINGLE DEGREE OF FREEDOM ORTHOGONAL COMPONENTS OF A FACTOR AT 2^K LEVELS IN TERMS OF LINEAR COMBINATIONS OF THE 2^K CONTRASTS OF K FACTORS AT 2 LEVELS
Joseph Weinstein Aug. 1966 13 p
(ECOM-2741; AD-638808) CFSTI: HC $1.00/MF $0.50

A computational procedure is developed which extends the use of Yates algorithm (for contrasts of two-level factors in an experimental design) to factors at 2^k levels. By use of K dummy factors at two levels, the 2^k levels of an experimental factor are represented as treatment combinations of the dummy variables. The components of the experimental factor are then related to linear combinations of the contrasts of the K dummy factors at two levels. The dependence of the linear combination on the original assignment of treatment combinations of the dummy factors is illustrated for two assignments for K = 2 Author (TAB)

N67-11099# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE USE OF THE AVERAGING METHOD TO SOLVE ONE EQUATION IN PARTIAL DERIVATIVES, ENCOUNTERED IN THE THEORY OF OSCILLATIONS
O. A. Zhautykov 17 Jun. 1966 14 p refs Transl. into ENGLISH from Prilizhennye Metody Resheniya Differentsialnykh Uravnenii (USSR), no. 2, 1964 p 52-61
(FTD-TT-65-1917; TT-66-62332; AD-639427) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: on the use of the averaging method to solve one equation in partial derivatives, encountered in the theory of oscillations. TAB

N67-11105# Wisconsin Univ., Madison. Mathematics Research Center.
CHARACTERIZATION OF LINE GRAPHS
D. K. Ray-Chaudhuri Apr. 1966 20 p refs
(Contract DA-11-022-ORD-2059)
(MRC-642; AD-638652) CFSTI: HC $1.00/MF $0.50

Let G be a finite undirected graph with at most one edge joining a pair of vertices and no edge joining a vertex to itself. L(G) denotes the line graph of G, i.e. the vertices of L(G) are the edges of G and two vertices of L(G) are adjacent if the corresponding edges of G are adjacent. Let D(U) denote the valence of a vertex u. Let d(g) denote the smallest integer which is equal to the valence of some vertex of u. For an edge (u,v), Δ(u,v) denotes the number of vertices w which are adjacent to both u and v. The main theorem of this paper is: If (i) $d(G) \geq 43$, (ii) h 2 is the minimum eigen-value of the adjacency matrix of G and (iii) for any edge (u,v), $\Delta(u,v) < \text{Min } (d(u) - 2, d(v) - 2)$, then G is isomorphic to L(H) for some graph H. Conversely if $d(H) > 3$, then the line graph L(H) satisfies conditions (ii) and (iii) stated above. Author (TAB)

N67-11180# Cornell Univ., Ithaca, N. Y. Dept. of Industrial Engineering and Operations Research
SOME EXTENSIONS OF SOMERVILLE'S PROCEDURE FOR RANKING MEANS OF NORMAL POPULATIONS
William R. Fairweather Jul. 1966 82 p refs
(Contract Nonr-401(53))
(TR-9; AD-638730) CFSTI: HC $3.00/MF $0.75

The formulation of a proposed two-stage procedure, for selecting the population with the largest mean from a set of normal populations with unknown means and a common known variance, is extended to an arbitrary, finite number of populations. The expected losses of the family of procedures generated by this extension are analyzed in detail (numerical results being obtained) for the special case of four populations. For this case, the family contains two 2-stage procedures (either one or two populations being discarded after the first stage) and it is found that, using appropriate allocations, while both have smaller maximum expected losses than does the corresponding one-state procedure, which one of the two-stage procedures is the better depends on the allocation. Methods of extending the formulation to multi-stage procedures are also considered. Certain multi-variate normal integrals with arbitrary correlation matrices and arbitrary limits of integration were evaluated numerically for 4- and 5-variate integrals. Author

N67-11182# California Univ., Berkeley. Operations Research Center.
SOME INEQUALITIES FOR SINGLE SERVER QUEUES
Kneale Thomas Marshall Aug. 1966 76 p refs
(Contract Nonr-222(83))
(ORC-66-19; AD-639168) CFSTI: HC $3.00/MF $0.75

The expected wait in the GI/G/1 queue is related to the mean and variance of the idle time. For arrival distributions which are IFR or have man residual life bounded by 1/lambda, simple bounds are obtained which give, for example, the expected number in queue to within at most one customer. By equating input with output, relations between random variables are used to obtain expressions for the moments of the waiting time in terms of moments of the inter-arrival, service, and idle time distributions. By bounding the idle time moments, bounds are obtained on the mean and variance of the waiting time, the mean length of a busy period, and the probability an arrival finds the system empty. Bounds on the mean wait lead to bounds on the expected virtual wait. Similar results are obtained for some generalizations of the G1/G/1 queue, including batch arrivals, batch service and priority queues. Queues where the first customer in each busy period has some added delay are also considered. Some preliminary results for tandem queues are given Author (TAB)

N67-11197# Stanford Univ., Calif. Dept. of Computer Science.
ACCURATE EIGENVALUES OF A SYMMETRIC TRI-DIAGONAL MATRIX
W. Kahan 22 Jul. 1966 57 p refs
(Contract Nonr-225(37))
(CS41; AD-638796) CFSTI: HC $3.00/MF $0.50

Having established tight bounds for the quotient of two different lub-norms of the same tri-diagonal matrix J, the author observes that these bounds could be of use in an error-analysis provided a suitable algorithm were found. Such an algorithm is exhibited, and its errors are thoroughly accounted for, including the effects of scaling, over/underflow and roundoff. A typical result is that, on a computer using rounded bloating point binary arithmetic, the biggest eigenvalue of J can be computed easily to within 2.5 units in its last place, and the smaller eigenvalues will suffer absolute errors which are no larger. These results are somewhat stronger than had been known before Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N67-10077# European Atomic Energy Community, Ispra (Italy). Protection Dept.
METEOROLOGY [7° ANNUARIO METEOROLOGICO] Annual Report No. 7, 1965
G. Bollini and C. Gandino Brussels, EURATOM, Jun. 1966 84 p refs In ITALIAN; ENGLISH summary
(EUR-2986.i) CFSTI: HC $3.00/MF $0.75

The meteorological Year 1965 is described following the methods of the preceding Annual Reports. After short descriptions of instruments and observed atmospheric phenomena, many tables and graphics are presented. Considering that the research arguments are treated on the monographs, enumerated after the index, this 7th Annual Report is limited to the general meteorological aspects, with the addition of the vertical thermal gradients, measured from the tower, the top of which is 120 m high. Author

N67-10241# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.
RADIO METEOROLOGY
B. R. Bean and E. J. Dutton 1 Mar. 1966 448 p refs
(NBS-Monograph-92) GPO: $2.75

CONTENTS:

1. THE RADIO REFRACTIVE INDEX OF AIR p 1–22 refs (See N67-10242 01-20)
2. MEASURING THE RADIO REFRACTIVE INDEX p 23–47 refs (See N67-10243 01-20)
3. TROPOSPHERIC REFRACTION p 49–88 refs (See N67-10244 01-20)
4. N CLIMATOLOGY p 89–172 refs (See N67-10245 01-20)
5. SYNOPTIC RADIO METEOROLOGY p 173–228 refs (See N67-10246 01-20)
6. TRANSHORIZON RADIO-METEOROLOGICAL PARAMETERS p 229–268 refs (See N67-10247 01-20)
7. ATTENUATION OF RADIO WAVES p 269–309 refs (See N67-10248 01-07)
8. APPLICATIONS OF TROPOSPHERIC REFRACTION AND REFRACTIVE INDEX MODELS p 311–374 refs (See N67-10249 01-20)

9. RADIO-METEOROLOGICAL CHARTS, GRAPHS, TABLES, AND SAMPLE COMPUTATIONS p 375–423 refs (See N67-10250 01-20)

N67-10242# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

THE RADIO REFRACTIVE INDEX OF AIR

In its Radio Meteorol. 1 Mar. 1966 p 1–22 refs (See N67-10241 01-20) GPO: $2.75

The classical equation for the radio refractive index is considered, recent determinations of the constants in this equation are summarized, and errors which occur during its use are analyzed. Normal gross features of the atmospheric refractive index structure are described, and emphasis is placed on this index in relation to the propagation of radio waves above 30 Mc/s. It is found that the differences in constants in the expression for N are small as compared with the error inherent in the formula; and the atmosphere, on the average, yields an exponential distribution of N with height. Use of an exponential model facilitates the preparation of climatic maps of N and clarifies the effect of non-normal N structure upon the bending rays. The refractive index is found to be effectively nondispersive for certain frequencies, as those below 50 Gc/s. M.W.R.

N67-10243# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

MEASURING THE RADIO REFRACTIVE INDEX

In its Radio Meteorol. 1 Mar. 1966 p 23–47 refs (See N67-10241 01-20) GPO: $2.75

Both indirect and direct measurement of the radio refractive index are discussed; and the latter which employs radio frequency refractometers rather than standard weather observations is considered preferable because accuracy is dependent upon a single sensor and N values are obtained directly. Because refractometers are relatively complex, expensive, and require a good deal of maintenance skill; the bulk of synoptic and climatological mapping of refractive index is based on indirect measurement means. The two measurement are compared, and it is noted that for many purposes indirect methods may be sufficiently accurate. Radiosonde lag constants are discussed, including theory of sensor time lags and radiosonde profile analysis. It is concluded that if studies of refractive index profile characteristics are to include sensor lag correction, then allowance should be made for temperature and humidity sensor time lags regardless of the climate; but that systematic application of these conclusions is dependent upon the accumulation of additional data. M.W.R.

N67-10244# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

TROPOSPHERIC REFRACTION

In its Radio Meterol. 1 Mar. 1966 p 49–88 refs (See N67-10241 01-20) GPO: $2.75

Numerical integration techniques and approximation methods are used to evaluate the bending total angular refraction of the ray path between two points, or the bending of the ray. This is accomplished without complete knowledge of the atmospheric radio refractive index (n) as a function of height. Model n-atmospheres are developed in order to evaluate average atmospheric refraction. Limitations to radio ray tracing are discussed, an approximation is developed for high initial elevation angles, and a statistical linear regression method is presented for determining high-angle bending. Attention is given to the linear or effective earth's radius model to account for the effects of atmospheric refraction of radio waves, as well as a modification of such a model. An exponential model is considered which assumes a single exponential distribution of N and is a close representation of the average refractivity structure within the first 3 km. A correction method for the initial gradient in radio propagation is mentioned, as is a graphical method for computing refraction in the troposphere. M.W.R.

N67-10245# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

N CLIMATOLOGY

In its Radio Meteorol. 1 Mar. 1966 p 89–172 refs (See N67-10241 01-20) GPO: $2.75

Surface variation of the radio refractive index on a worldwide scale is studied in a reduced-to-sea-level form that presents more accurate results than unreduced data. The mean vertical structure of the refractive index parameter in the troposphere over central North America is presented in this reduced form, and a climatological treatment is given to the atmospheric duct or waveguide phenomena and associated fading regions. Refraction of radio waves in various air masses is considered, and it is shown that differences within air masses are due to changes in refractive index structure. M.W.R.

N67-10246# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

SYNOPTIC RADIO METEOROLOGY

In its Radio Meteorol. 1 Mar. 1966 p 173–228 refs (See N67-10241 01-20) GPO: $2.75

Time and space variations of refractive index structure with synoptic tropospheric disturbances surveyed are microscale fluctuations, mesoscale variations, and broad-scale systems of weather map dimensions. This survey is intended to show the direction of radio meteorological research and to point out synoptic features that are likely to have refractive index significance. Features discussed include the interrelationship of refractive index structure and mesoscale weather changes and migratory high and low pressure cells of the middle latitudes. Mesoscale and microscale synoptic data permit the propagation engineer to anticipate the occurrence of super-refraction or ducting conditions. M.W.R.

N67-10247# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

TRANSHORIZON RADIO-METEOROLOGICAL PARAMETERS

In its Radio Meteorol. 1 Mar. 1966 p 229–268 refs (See N67-10241 01-20) GPO: $2.75

Radio data from VHF paths are discussed and classified in terms of refractive index profiles, and a parameter is introduced which combines the concepts of refraction and atmospheric stability. Thermal stability and adiabatic lapses of N are discussed for this turbulence parameter; and a comparison is made between the various radio-meteorological parameters. An analysis of the VHF field strength variations and refractive index profiles deal with (1) radio and meteorological data, (2) classification of radio field strengths by profile types, (3) prediction of field strength for unstratified conditions, (4) effect of elevated layers beyond the horizon for four Illinois paths, (5) elevated layers of temperature inversion, and (6) the influence of small layers. It is noted that any departure of refractive index structure from a smooth monotonic decrease with height produces an increase in field strength on a 200-km path in the frequency band of 70 to 180 Mc/s; and elevated tilted layers are found in signal enhancement of 10 to 25 dB over values for unstratified conditions at all percentage levels. M.W.R.

N67-10249# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

APPLICATIONS OF TROPOSPHERIC REFRACTION AND REFRACTIVE INDEX MODELS

In its Radio Meteorol. 1 Mar. 1966 p 311–374 refs (See N67-10241 01-20) GPO: $2.75

The bi-exponential nature of the tropospheric radio refractive index is discussed, as are dry and wet term scale height properties. It is noted that a bi-exponential model of atmospheric refractive index does reflect physical properties better than does a single exponential model. The effect of atmospheric horizontal inhomogeneity upon ray tracing is discussed, and a comparison is made of observed radio refraction effects based on predictions

from surface weather observations. Attention is given to various aspects of the correction of atmospheric refraction errors in radio height finding, including the refractive index, ray theory, use of effective earth radius, height errors, estimation of average gradient, and use of regression analysis. M.W.R.

N67-10250# National Bureau of Standards, Boulder, Colo. Central Radio Propagation Lab.

RADIO-METEOROLOGICAL CHARTS, GRAPHS, TABLES, AND SAMPLE COMPUTATIONS

In its Radio Meteorol. 1 Mar. 1966 p 375–423 refs (See N67-10241 01-20) GPO: $2.75

Sample computations of atmospheric refraction are presented, along with tables of refraction variables for the exponential reference atmosphere. Refractivity tables are also included, and climatological data of the refractive index for the United States are charted on the basis of 8-year mean values. The statistical prediction of elevation angle error is discussed, and tables give values for different heights. M.W.R.

N67-10260# Washington Univ., Seattle. Dept. of Atmospheric Sciences.

AN ANALYSIS OF CARBON DIOXIDE IN THE ARCTIC ATMOSPHERE AT BARROW, ALASKA DURING 1961–1962–1963

John J. Kelley, Jr. Jul. 1966 140 p refs

(Contract Nonr-477(24))

(TR-7; Rept.-2; AD-638032) CFSTI: HC $4.00/MF $1.00

The results of the measurements of carbon dioxide in air at Barrow, Alaska are presented. Reference gas comparison data are tabulated, and the methods of calculations are discussed. The average daily concentrations of atmospheric carbon dioxide are tabulated for the period 10 July 1961 to 2 October 1963. The diurnal variations of carbon dioxide during this period are also presented. Results of the analysis of carbon dioxide in air, collected in flasks from several locations in addition to Barrow, are given. TAB

N67-10290# Miami Univ., Coral Gables, Fla. Radar Meteorological Lab.

MESOSCALE STUDIES OF INSTABILITY PATTERNS AND WINDS IN THE TROPICS Semiannual Report, 1 Dec. 1965–31 May 1966

Harold P. Gerrish and Homer W. Hiser Ft. Monmouth, N. J., Army Electron. Command, Aug. 1966 58 p refs

(Contract DA-28-043-AMC-00443(E))

(SAR-2; Rept.-11; ECOM-00443-2; AD-638222) CFSTI: HC $3.00/MF $0.75

Two of the most remarkable rainstorms in Florida's history are described and analyzed. The storm of 13 to 15 October 1965 produced total amounts in excess of 26 inches with 24.43 inches falling in 24 hours at Bahia Mar in Fort Lauderdale and 21.28 inches in 12 hours at Pompano Beach on the 14th. The Halloween storm of 30 October to 1 November 1965 produced total amounts on the order of 14 inches in the same general area with a questionable report of 20 inches in 24 hours in the Boca Raton area. If this report is correct, it is the first time in history that separate storms have produced 20 inches or more rain in 24 hours over the same level terrain in such a short period of time, at least in this part of the world. The heavy rates for 12 and 24 hours in the mid-October storm are quite rare, being exceeded on the order of only 6 times in the past century in the continental United States. The heaviest rain in both storms was triggered by an asymptote of confluence oriented SE-NW over the area at 850mb. Subsequent vortex development occurred but was confined below the melting level and was of minor importance as far as producing rain in the Fort Lauderdale-Pompano Beach area. Aside from isohyetal analysis and synoptic aspects, particular emphasis is placed on: precipitable water, raob analysis, divergence, vorticity, and preliminary radar aspects Author (TAB)

N67-10298# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.

AIRCRAFT INVESTIGATIONS OF ATMOSPHERIC ELECTRICITY AND THUNDERSTORM DEVELOPMENT IN RELATION TO THE ATMOSPHERIC ELECTRICITY DETECTION SYSTEM AT CAPE KENNEDY, FLORIDA Final Scientific Report, Mar. 1965–Mar. 1966

Arthur L. Handman 17 Mar. 1966 146 p refs

(Contract AF 19(628)-5116)

(Rept.-2967; AFCRL-66-529; AD-638641) CFSTI: HC $4.00/MF $1.00

The objectives of the program were achieved analytically by first determining the physical basis for the 500-khz radiation detected by the SPARSA (Sferics Pulse, Azimuth, Rate, and Spectrum Analyzer) sensor, and then relating the detected sferics pulses to actual thunderstorm conditions. From the analysis of over 100 hours of in-flight data, the following conclusions are summarized: (1) Although several limitations were found to exist in the system, the operational warning for hazardous atmospheric electrical activity was derived from: (a) a positive SPARSA network response to active thunderstorms and resultant position fix by triangulation, (b) a lack of deflections or fixes in areas devoid of thunderstorm activity except in response to certain kinds of radio and microwave interference, (c) an early indication of approaching thunderstorms. (2) In a limited investigation, it was possible to vector aircraft around severe storm areas, using the SPARSA network deflections. (3) A similarity in response to thunderstorm activity was discovered between an airborne sferics detector and SPARSA sensor deflections which, when combined with proximity detector on the aircraft, proved the feasibility of the concept. Limitations of the network are discussed, and recommendations for network improvement are given Author (TAB)

N67-10387# Joint Publications Research Service, Washington, D. C.

ELECTRONIC-MECHANICAL METHOD OF MEASURING AIR CURRENT VELOCITIES

Yu. S. Anokhin 31 Oct. 1966 6 p Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 50–51

(JPRS-38403; TT-66-34829) CFSTI: $1.00

A differential manometer for measuring averaged values of wind velocity and registering large scale fluctuations on an automatic recorder or a loop oscillograph, is described. S.C.W.

N67-10391# Joint Publications Research Service, Washington, D. C.

BASIS OF A SNOW-SURVEYING METHOD

D. L. Laykhtman and I. D. Kopanev 31 Oct. 1966 8 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 12–15

(JPRS-38408; TT-66-34834) CFSTI: $1.00

Experimental data used to derive formulas for computing snow parameters are analyzed. Data show that the relationship between the depths of the snow cover at closely lying points is statistically characterized by a definite correlation between the depths of the snow cover at adjacent points, and that this correlation decreases uniformly with increasing distance between the points. On the basis of these findings, formulae were generated for determining the mean square error of the depth of the snow cover, and variability of snow cover depth and density during the winter in relation to the selection of a rational time interval between snow surveys. S.C.W.

N67-10392# Joint Publications Research Service, Washington, D. C.

CONFERENCE OF THE DIRECTORS OF THE HYDRO-METEOROLOGICAL AND METEOROLOGICAL SERVICES OF THE SOCIALIST COUNTRIES OF EUROPE

I. V. Kravchenko 31 Oct. 1966 9 p Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 46–49 Conf. held in Moscow, 21–28 Feb. 1966
(JPRS-38404; TT-66-34830) CFSTI: $1.00

A synopsis is presented of Conference resolutions and recommendations which focused on eliminating problems in the followin areas: climatology, agrometeorology, aviation and synoptic meteorology, meteorological telecommunications, hydrometeorological instrumentation, coordination of scientific research, and problems of a universal weather service. S.C.W.

N67-10393# Joint Publications Research Service Washington, D. C.
CHOICE OF PARAMETERS OF INFLUENCE FUNCTIONS USING AN ANALOG COMPUTER
A. G. Levin and Ye. N. Borshchevskiy 31 Oct. 1966 6 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 35–37
(JPRS-38406; TT-66-34832) CFSTI: $1.00

An analog computer method for determining the parameters of the arrival curves (influence functions) of high water waves in segments of a water channel with or without tributaries is described. It is shown that if observational data are available at the closing measuring post of a channel, the length of the channel can be determined on the basis of computed and existing hydrographs. S.C.W.

N67-10394# Joint Publications Research Service, Washington, D. C.
NUMERICAL WEATHER FORECASTING METHODS USED IN THE USSR HYDROMETEOROLOGICAL SERVICE
V. A. Bugayev and S. L. Belousov 31 Oct. 1966 16 p Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 3–11
(JPRS-38409; TT-66-34835) CFSTI: $1.00

The application of computer techniques and numerical methods to the daily routine weather forecasts made by the Soviet hydrometeorological service is discussed. Plans to adopt these methods at future regional meteorological centers and their immediate prospects in the fields of both long-range and short-range forecasting are also mentioned. R.N.A.

N67-10400# Joint Publications Research Service, Washington, D. C.
METEOROLOGICAL SERVICING OF RAILROAD TRANSPORTATION
D. M. Mel'nik 31 Oct. 1966 8 p refs Transl. into ENGLISH from Meteorol. i Gidrol. (Moscow), no. 8, 1966 p 33–35
(JPRS-38407; TT-66-34833) CFSTI: $1.00

Methods for preventing the harmful effects of blizzards on railroads and agricultural production are discussed. Proposed is the use of meterological data for establishing statistical patterns of snow formation in different geographical regions of the Soviet Union. The development of engineering hydrometeorology as an applied science which would focus on establishing norms for planning, construction, and operation of industrial, transportation, and agricultural technology in areas effected by heavy snowfalls and blizzards; is advocated. It is concluded that with the development of these norms, a sound basis for supplying roads with adequate means for snow protection, selecting effective snow machines, and developing snow switching apparatus, will be provided. S.C.W.

N67-10405# Air Force Cambrdge Research Labs., Bedford, Mass. Aerospace Instrumentation Lab.
STATISTICS OF PARAMETERS AFFECTING TETHERED BALLOON FLIGHTS
Joseph Hess Jul. 1966 37 p refs *Its* Surv. in Geophysics No. 182
(AFCRL-66-480; AD-637853) CFSTI: HC $2.00/MF $0.50

Climatological statistics of parameters affecting tethered balloon flights are presented for a proposed tethered balloon project at Key West, Florida. (Author) TAB

N67-10442# Chicago Univ., Ill. Dept. of Geophysical Sciences.
PROJECT WHITETOP. A CONVECTIVE CLOUD RANDOMIZED SEEDING PROJECT. PART I: DESIGN OF THE EXPERIMENT. PART II: SUMMARY OF OPERATIONS Final Report
Roscoe R. Braham, Jr. Aug. 1966 154 p refs

Rain production in summer convective clouds of the midcontinent and the effects of randomized silver iodide seeding were studied. Emphasis was placed on physical measurements in nonorographic, convective clouds, both seeded and nonseeded. Details are presented on the procedures and equipment used. The data and results are summarized. The results indicated that the condensation-coalescence mechanism is responsible for initiating precipitation and for setting the stage for the ice phase through the production of large water drops which can freeze at relatively warm temperatures. After freezing, growth was largely due to riming with cloud droplets to form snow pellets and graupels. The enhanced rate of growth of a snow pellet over an equivalent water drop is pointed out. It was assumed that the drop freezing in cumulus clouds is associated with the production of the ice splinters. N.E.N.

N67-10462# Freie Univ., Berlin (West Germany). Inst. for Meteorology and Geophysics.
METEOROLOGICAL DATA. VOLUME LIV, NO. 6: DAILY AND MEAN SURFACE AND 300 mb MAPS OF THE NORTHERN HEMISPHERE IN THE YEAR 1965–JUNE [METEOROLOGISCHE ABHANDLUNGEN. BAND LIV, NO. 6: TAEGLICHE UND MITTLERE BODEN- UND 300-mb-KARTEN DER NORDHEMISPHAERE IM JAHRE 1965–JUNI]
Stanislav Debenec, Manfred Geb, Barbara Kriester, Richard Scherhag, and Renate Stuhrmann 1965 73 p In GERMAN
CFSTI: HC $3.00/MF $0.75

Presented are the daily and median ground and 300-mb graphs of the Northern Hemisphere for June, 1965. Millibar measurement anomalies formed a persistant pattern in relation to the observed pressure zones and were most pronounced in a loop area around the subpolar region. Low temperature areas covered a large part of the observed regions, and the median temperature values for the Northern Hemisphere in general showed a decrease of −0.25°C in comparison with the preceeding 30 years. The tropical precipitation zone also displayed widespread anomalies. Transl. by G.G.

N67-10584# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
ON THE DISSIMILARITY BETWEEN HEAT AND MOMENTUM TRANSFER IN THE STABLE ATMOSPHERE NEAR THE GROUND Final Report, 1 Apr. 1963–31 Dec. 1965
Joost A. Businger and Naydene N. Maykut May 1966 24 p refs
(Contract AF 19(628)-2476)
(AFCRL-66-457; AD-637847) CFSTI: HC $1.00/MF $0.50

A fixed layer in the stable atmosphere near the ground shows a remarkable correlation between Delta-u and Delta-Theta when the average RI number is larger than 0.08. Through the study of time sequences of temperature and wind, evidence of the periodic breakdown of the inversion layer was observed and some interesting aspects of the stable atmosphere were revealed. The effect of the correlation between Delta-u and Delta-Theta on the (K sub H)/(K sub M) was investigated. The (K sub H/K sub M) ratio decreases with height in the stable atmosphere and therefore must be smaller than one. However, it shows an ambiguous behavior with respect to RI which suggests that RI is not the only relevant parameter in describing the stable atmosphere. It is

evident that the stable atmosphere behaves in a more complex way than the unstable atmosphere and that future work in this area should divorce itself more strongly from the techniques that are being used to describe the unstable atmosphere
Author (TAB)

N67-10953# Elcon Lab., Inc., Salem, Mass.
MEASUREMENT OF ATMOSPHERIC EXTINCTION AND LIGHT SCATTERING FUNCTION. PART III: APPARATUS FOR MEASUREMENT OF ATMOSPHERIC EXTINCTION
Edwin Langberg Jul. 1966 85 p refs
(Contract DA-36-039-AMC-02256(E))
(R-5-66-1; ECOM-02256-F, Pt. II; AD-637796) CFSTI: HC $3.00/MF $0.75

The extinction meter is capable of automatically measuring the extinction coefficient of air at one wavelength for conditions ranging from pure air to dense haze conditions. The meter is selfcalibrating so that only a minimum of periodical calibrating is necessary.
TAB

N67-11018# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
COMPARISON OF ROCKETSONDE AND RADIOSONDE TEMPERATURES AND A VERIFICATION OF COMPUTED ROCKETSONDE PRESSURE AND DENSITY
Otto W. Thiele and Norman J. Beyers Apr. 1966 33 p refs
(ECOM-5048; AD-639116) CFSTI: HC $2.00/MF $0.50

Two diurnal series of rocketsonde temperature measurements complemented by hypsometer-type balloon-borne radiosondes are examined in the overlap region extending from approximately 20 to 32 km altitude. Considering time and space variability, the average temperature difference found in a comparative analysis of corresponding radiosonde and rocketsonde measurements of only 1.26 degrees Celsius (radiosonde colder) through the layer demonstrates exceptionally good agreement particularly since this systematic difference is primarily attributable to excessive infrared cooling of the radiosonde rod thermistor. Since a tie-on pressure from the radiosonde in the overlap region is used to compute pressure and density up to approximately 60 km from the rocketsonde direct temperature measurement, the reliability to be expected from this procedure is also demonstrated. A more recent experiment in which an independent one-point pressure sensor was incorporated with the rocketsonde verified the computed pressure at 55 km. The resultant 1.7 percent pressure difference is within the accuracy limitations of the radiosonde pressure measurement at the tie-on level
Author (TAB)

N67-11025# Air Weather Service, Scott AFB, Ill.
REGRESSION EQUATIONS FOR SPECIFYING ATMQSPHERIC DENSITY 30 KM FROM OBSERVATIONAL DATA AT RADIOSONDE ALTITUDES
Roderick S. Quiroz and Gary J. Thompson Aug. 1966 34 p refs
(TR-187; AD-639566) CFSTI: HC $2.00/MF $0.50

Analysis of a small rocket data sample from the Soviet observing site at Heiss Island (81 degrees N) indicated a high correlation between the density of the upper stratosphere and the temperature and pressure at certain altitudes in the lower stratosphere. Strong density-temperature and density-pressure relationships may be anticipated under certain conditions from consideration of the hydrostatic equation and the equation of state, the latter differentiated with respect to height. Large samples of rocket observational data for a northerly and a southerly station were specially processed to yield correlation coefficients for all possible pairs of altitudes between 20 and 60 km. Knowledge of maxima in the vertical profiles of the correlation coefficients then made it possible to construct regression equations with minimum standard error of estimate. It is shown that such equations may be used to predict the density satisfactorily at altitudes up to about 50 km from radiosonde observational data on the thermodynamic state of the lower stratosphere. Incidental to the development of the prediction equations is a discussion of the observed patterns of the intra-level correlation of density with temperature and pressure and the inter-level correlation of density with temperature, pressure, and density, to 80 km
Author (TAB)

N67-11030# White Sands Missile Range, N. Mex.
COMPARISON OF NINE PROFILE MODELS FOR THE DIABATIC BOUNDARY LAYER
Frank V. Hansen Jun. 1966 42 p refs
(ECOM-5054; AD-639114) CFSTI: HC $2.00/MF $0.50

Nine diabatic models used to describe the shape of the wind and temperature profiles in the surface boundary layer have been compared using factors common to all, such as the gradient Richardson number, the diabatic influence function, and the function psi(z/L). Numerical integration of the models was accomplished using high-speed digital computer techniques. Experimental data used to evaluate the models were collected at locales of known surface roughness. All models are considered to be valid for a small range of stability but tend to diverge rapidly beyond the transition zone between forced and free convection. Application to data obtained at White Sands Missile Range showed that none of the models was suitable for analysis of data observed under nonstationary conditions
Author (TAB)

N67-11049 Chicago Univ., Ill. Dept. of the Geophysical Sciences.
THREE-DIMENSIONAL GROWTH CHARACTERISTICS OF AN OROGRAPHIC THUNDERSTORM SYSTEM
Rodger A. Brown May 1966 50 p refs
(Contract AF 19(628)-4807; Grant CWB-WBG-70)
(SMRP-RP-61; AD-637883) CFSTI: HC $2.00/MF $0.50

A thunderstorm, which developed over the San Francisco Peaks near Flagstaff, Arizona on 1 August 1961, is studied with the use of surface stereo-pair and aerial photographs. The photographs are used to investigate both the vertical growth rate of the tops of numerous cloud elements and the rate of increase of mass within the entire cloud system. Photographic evidence of the unique cloud feature which signifies the transition from a cumulus congestus into a cumulonimbus is presented. Analyses of surface data from the mesometeorological network around the Peaks reveal that the precipitation area remained near the leeward slopes as the mountain-anchored cloud mass extended to the north. Based on this and previous studies, the energy available for the growth of cumuli and cumulonimbi are determined; values of the order of 10 to the 22nd power ergs for cumulonimbi agree with values obtained by Braham (J. Meteor, 9:227-242 (1952)), who used an entirely different approach. The Appendix contains a detailed description of the photogrammetric techniques used to obtain measurements from the clouds seen in the aerial photographs
Author (TAB)

N67-11085# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBILITIES OF RADAR INVESTIGATION OF CLOUD STRUCTURE
A. M. Borovikov, V. V. Kostarev, and I. P. Mazin 7 Jun. 1966 15 p refs Transl. into ENGLISH from Tr. Vses. Nauchn. Issled. Inst. Meteorol. (Leningrad), v. 5, 1963 p 325-332
(FTD-TT-65-1859; TT-66-62337; AD-634438) CFSTI: HC $1.00/MF $0.50

It is shown that (1) radar methods of investigating clouds already now permit rich information to be obtained about the distribution of large particles in clouds, which is in itself of great importance, since it allows deeper penetration into the physics of cloud formation processes and precipitation; and that (2) use of the ratiowave absorption phenomenon in clouds open real perspectives of determining water content and cloud boundaries with the aid of a special radar apparatus.
Author (TAB)

N67-11158# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIENCE IN THE ANALYSIS OF A WIND-VELOCITY HODOGRAPH IN THE BOUNDARY LAYER OF THE ATMOSPHERE

A. V. Tkachenko, N. M. Volevakha, and N. M. Galadzhiy 21 Jun. 1966 16 p refs Transl. into ENGLISH from the publ. "Voprosy Fizika Atmosfery" Leningrad, Ukr. Nauchn. Issl. Gidrometeorologicheskogo Inst., 1962 p 48–53
(FTD-TT-65-2022; TT-66-62313; AD-639333) CFSTI: HC $1.00/MF $0.50

Some preliminary results are presented of the analysis of a wind-velocity hodograph in the boundary layer of the atmosphere in a comparison with data obtained by other methods. Author (TAB)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N67-10030# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

PRELIMINARY REPORT ON THE STATE-OF-THE-ART OF OMEGA. A VLF-LONG-RANGE HYPERBOLIC RADIO-NAVIGATION TECHNIQUE FOR PRESENT AND FUTURE AIR-TRANSPORT AND SEA-TRANSPORT REQUIREMENTS

H. J. Bos Aug. 1966 29 p refs
(TDCK-45074) CFSTI: HC $2.00/MF $0.50

This report comprises a review of the development-history, of the present-day requirements and availability, as well as of future-aspects. The consulted literature is referenced chronologically with 40 items and the report is presented in nine chapters. A summary of technical details and a system-description are included. Author

N67-10421# Bendix Corp., Teterboro, N. J. Special Devices Lab.

EVALUATION OF INERTIAL NAVIGATION SYSTEM IN CIVIL AIR TRANSPORT OPERATIONS. VOLUME II: BANC-461 STEERING COMPUTER PERFORMANCE

H. R. Walcott and John Kilmartin 15 Jun. 1966 156 p *Its* Publ.-7311-66-17R
(Contract FA-64-WA-5208)
(RD-66-30-II)

This final report summarizes the work performed to evaluate the first autopilot coupled Inertial Navigation System installed in a commercial jet aircraft engaged in regular scheduled passenger operations. Data taken during 185 flight legs of 43 flights is analyzed for BANC-461 Steering Computer Performance. Predicted errors from an earlier report are compared with flight results. Author

N67-10430# Eastern Air Lines, Inc., Miami, Fla. Meteorology Dept.

FLIGHT OBSERVATIONS OF ATMOSPHERIC TURBULENCE Final Report

Paul W. Kadlec Jun. 1966 52 p refs
(Contract FA-66-WA-1449
(FAA-RD-66-72)

A summary of observations is provided from the analysis of data collected on 963 flights by a research meteorologist riding in the cockpit of airline and military jet aircraft. Three cloud pattern models are described that associate cirrus formed by jet streams with areas of occurrence of significant turbulence. A refinement in the theory that atmospheric temperature changes may indicate clear air turbulence indicates that a rate of temperature change of 1.0°C per minute with a total change of 2.0°C is the most effective combination for detecting impending significant turbulence. Clear air vortices that form below the base of severe thunderstorms may produce turbulence capable of upsetting multi-engine jet aircraft. The formation of these vortices occurs in the precipitation-free area of the thunderstorm. An airborne portable scintillometer was flight tested to determine the feasibility of detecting clear air turbulence by means of aircraft optical observations. Author

N67-10448# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.

NEW YORK INTERIM COMMON TRACON FACILITY SIMULATION STUDY Final Report

Ricardo Cassell Jul. 1966 136 p refs
(RD-66-42)

In the first phase of the simulation studies, equipment and controller arrangement configurations were explored and a single configuration was ultimately developed. In the second phase, the plan was evaluated using the configuration developed. It was concluded that the basic console design provided adequate space for all anticipated required equipments and allowed for optimum controller placement for large screen display viewing. The console design was not considered optimum for the positions located at a second row of consoles since these positions did not use the large screen displays. The equipment configuration provided an environment in which intrafacility coordination was facilitated. Author

N67-10478# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).

AERONAUTICAL ALMANAC, SEPTEMBER–DECEMBER 1966 [ALMANAQUE AERONAUTICO, SEPTIEMBRE–DECIEMBRE 1966]

1966 263 p In SPANISH
CFSTI: HC $6.00/MF $1.25

Astronomical tables for use by pilots in navigation and positioning are presented. Data for single days are tabulated on throw-away, perforated sheets, and include details of hour angle interpolation for determining latitude, critical tables, and turning points tables. Hourly declinations by tenths of minutes, Greenwich mean time, are listed for Venus, Mars, Jupiter, and Saturn. The magnitude and sidereal angles are also given for 57 of the most brilliant start stars. Transl. by R. Ll.

N67-10592# General Electric Co., Daytona Beach, Fla.

HYBRID SIMULATION OF SPACE VEHICLE GUIDANCE SYSTEMS

R. A. Heartz and T. H. Jones [1964] 12 p refs

The conditions are described under which hybrid simulations are appropriate to an engineers' understanding of how various trade-offs, or changes in system parameters, affect overall system performance. Hybrid computers and factors affecting the design of the simulation are discussed, and a simulation of a lunar landing guidance system is presented. Several typical examples which indicate how the simulation can be applied to assist the guidance engineer in the analysis and synthesis of the guidance system are included. A.G.O.

N67-11086# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF THE INVARIANCE THEORY TO THE SYNTHESIS OF INERTIAL NAVIGATIONAL SYSTEMS

Ye. G. Smenkovskiy Jun. 1966 17 p refs Transl. into ENGLISH from the book "Teoriya Invariantnosti v Sistemakh Avtomaticheskogo Upravleniy A" Moscow, 1964 p 449–456
(FTD-TT-66-1860; TT-66-62360; AD-639554) CFSTI: HC $1.00/MF $0.50

Translation of Russian research; application of the invariance theory to the synthesis of inertial navigational systems. TAB

N67-11113# Environmental Science Services Administration, Atlantic City, N. J. Weather Bureau.
EVALUATION OF SEVERAL MULTI-TRANSMISSOMETER SYSTEMS Interim Report
Matthew Lefkowitz and Ernest E. Schlatter Jul. 1966 42 p refs Prepared for FAA
(RD-66-45)

A test program has been developed and implemented to evaluate multi-transmissometer systems. These consist primarily of instruments at touchdown, midpoint, and roll-out locations at five airfields located at Atlantic City, N. J., New York City, N. Y., Chicago, Ill., Denver, Colo., and Los Angeles, Calif. The data acquisition technique and program are described. Preliminary analysis of a small data sample indicates that while large differences may exist between instrument locations, they tend to diminish as visibility decreases. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N67-10021# United Kingdom Atomic Energy Authority, Harwell (England). Engineering Div.
THE DEVELOPMENT OF A HIGH TEMPERATURE GRAPHITE RIG FOR SCATTERING LAW EXPERIMENTS
L. A. W. Bedford Jul. 1966 23 p
(AERE-R-5217) HMSO: 3s

The development was carried out in two stages. A Mark I rig was built and run at a maximum temperature of 1500°C using an argon atmosphere. This rig has been used successfully on the Phased Rotor Neutron Spectrometer. Experience gained with Mark I enabled a Mark II rig to be built and this has been tested at a maximum temperature of 2000°C for long periods. It was possible to run this rig in a vacuum and enabled a reduction in power input to be made compared with the same specimen temperature in Mark I. The two rigs both used the specimen as its own resistance heater. Radiation shields of minimum number and thickness are used together with a local thin section in the containment vessel, to reduce scattering from materials other than the specimen. A demountable, circumferential thin metal window was developed for Mark II and has proved very reliable. Author

N67-10022# Atomic Energy Establishment, Winfrith (England). Steam Generating Heavy Water Reactor Development Div.
METHUSELAH II–A FORTRAN PROGRAM AND NUCLEAR DATA LIBRARY FOR THE PHYSICS ASSESSMENT OF LIQUID-MODERATED REACTORS
M. J. Brinkworth and J. A. Griffiths Mar. 1966 52 p refs
(AEEW-R-480) HMSO: 7s

METHUSELAH II is a Fortran program with a nuclear data library, used to calculate cell reactivity and burn-up in liquid-moderated reactors. It has been developed from METHUSELAH I by revising the nuclear data library, and by introducing into the program improvements relating to nuclear data, improvements in efficiency and accuracy, and additional facilities which include a neutron balance edit, specialised outputs, fuel cycling, and fuel costing. These developments are described and information is given on the coding and usage of versions of METHUSELAH II for the IBM 7030 (STRETCH), IBM 7091, and KDF9 computers. Author

N67-10056# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
THE SORA PROJECT READY FOR ITS REALIZATION
G. Ritter Brussels, Euratom, Jul. 1966 24 p refs Submitted for Publication
(EUR-3057.e) CFSTI: HC $1.00/MF $0.50

This report contains a short description of the status of the art in the research and development program for the fast pulsed reactor SORA. With the completion of the SORA-critical experiment, a joined U.S.A.E.C.-EURATOM effort, all the relevant reactor parameters are now also experimentally confirmed. Experimental results and theoretical predictions coincide within experimental errors. With these results in hand, no undue risk is involved in the immediate construction of this reactor and its intended use in the field of neutron physics. Author

N67-10100 Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Institut fuer Chemie.
INVESTIGATION OF THE FISSION PRODUCT DIFFUSION IN THE TREATMENT OF FUEL PARTICLES FOR HIGH TEMPERATURE REACTORS [UNTERSUCHUNG UEBER DIE SPALTPRODUKTVERTEILUNG IN DER BESCHICHTUNG VON BRENNSTOFFTEILCHEN FUER HOCHTEMPERATUR-REAKTOREN]
L. Szterk (Inst. fuer Atomkernforsch. Warschau) and H. Bildstein 1966 22 p refs In GERMAN; ENGLISH summary Submitted for Publication Supported by the IAEA and the Austrain Govt.
(SGAE-CH-36/1966) CFSTI: HC $1.00/MF $0.50

The diffusion of fission products into the coating of PyC-coated fuel particles for high temperature reactors is investigated. The coating of irradiated particles was removed stepwise chemically and the resulting etching solutions analyzed by gamma spectrometry. The experiments were performed on particles with sintered and melted (U, Th)C_2-kernels. The release of fission products as Ba/La, Zr, Ru and Cs is described. Author

N67-10189*# National Aeronautics and Space Administration, Washington, D. C.
NUCLEAR POWER FOR SPACE TRAVEL
H. Schultze 15 Jan. 1964 7 p Transl. into ENGLISH of the Manuscript Frankfurt Am Main, Umschau Verlag, 1964
(NASA-TT-F-8-8807) CFSTI: HC $1.00/MF $0.50 CSCL 21F

The early and practical utilization of nuclear energy in space is a major goal of NASA's advanced propulsion and power generation program. To this end a program has been adopted to utilize only the technical possibilities available in the near future. The program is compsed of two major parts: nuclear rocket systems and nuclear electric power and propulsion systems. A large portion of these programs is a combined effort by the Atomic Energy Commission (AEC) and the National Aeronautics and Space Administration (NASA). Author

N67-10267*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SNAP-8 DEVELOPMENT STATUS
Henry O. Slone *In its* Space Power Systems Advanced Technol. Conf. 1966 p 147–168 (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

The current status of technical development for the SNAP-8 reactor and the power conversion system are discussed. Major components such as the reactor, mercury boiler, condenser, the turbine-alternator assembly, and motor assembly are considered. The lubricant-coolant pump, mercury pump, and sodium-potassium pump are mentioned with respect to the motor assembly. The potential problem of mercury corrosion of the containment material in a mercury system is examined, and corrosion rates of an iron-base alloy are shown. Test times for the major components of the power-conversion system are tabulated. Listed are the number of units tested, the accumulated test time for all units, and the longest test time accumulated on a single unit. Only one unit, the turbine-alternator assembly, exhibited lower performance than expected. S.P.

N67-10268*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POTASSIUM RANKINE SYSTEM MATERIALS TECHNOLOGY

Louis Rosenblum, David R. Englund, Jr., Robert W. Hall, Thomas A. Moss, and Coulson Scheuermann *In its* Space Power Systems Advanced Technol. Conf. 1966 p 169–199 (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

This discussion mainly concerns the working fluid, potassium, and the containment materials, alloys of the refractory metals columbium and tantalum. Some of the problems inherent in the application of these materials to space power systems are presented, and the more significant results of the materials investigation are summarized. The oxidation problem, present in ground test operations, was brought into focus. The probable rate determining process in the low pressure oxidation of columbium and tantalum alloys were identified, and the requirements for vacuum test environments were defined. Test results indicate that the creep strength of available commercial columbium and tantalum alloys is adequate for system operating times and temperatures. Investigations of the compatibility of container materials with potassium indicate that the gettered columbium and tantalum alloys have adequate corrosion resistance. H.S.W.

N67-10269*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POTASSIUM RANKINE SYSTEMS TECHNOLOGY

Robert E. English, Robert L. Cummings, Robert L. Davies, Thomas P. Moffitt, and Uwe H. von Glahn *In its* Space Power Systems Advanced Technol. Conf. 1966 p 201–238 (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

The technology of potassium vapor Rankine cycle turbogenerator power systems is reviewed. The system considered contains four loops: a reactor loop, a power loop, a heat rejection loop, and a cooling loop. The research conducted on a variety of constituent problems of this system is discussed. On the basis of corrosion and strength, maximum temperatures of 2200° to 2400° F appear practical. It is reported that adequate information has been obtained on the heat transfer coefficients and pressure drops of boiling and condensing potassium, and that general knowledge of the problem of boiling stability is advancing. Design information on bearings, seals pumps, and electrical materials is accumulating. It is considered that the thermal design of radiators is improving, and that the meteoroid satellites provide additional confidence that reliable radiators can be designed. H.S.W.

N67-10270*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THERMIONICS

Roland Breitwieser and Herman Schwartz *In its* Space Power Systems Advanced Technol. Conf. 1966 p 239–268 refs (See N67-10261 01-03) CFSTI: HC $3.75/MF $1.50

The state of art of several aspects of thermionics as it is considered in the framework of a space power system is reviewed herein. The principle of thermionics is discussed, and a brief exposure to some pertinent characteristics of thermionic converter systems is introduced. Primary emphasis is placed on (1) establishing the major performance constraints based on fundamental surface and plasma physics, (2) illustrating empirical performance, (3) introducing a few reactor-converter interface considerations, and finally (4) reviewing some limitations of prospective thermionic nuclear reactor fuels. Author

N67-10474# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

HELENA CODES FOR MATERIAL BUCKLING DETERMINATION IN SUBCRITICAL ASSEMBLIES

Cyryl Dabrowski and Andrzej T. Mikulski Oct. 1965 95 p refs (INR-659/IXA/RP) CFSTI: HC $3.00/MF $0.75

Codes for computation of material buckling from thermal neutron flux distributions in an unreflected subcritical assembly, written in GIER ALGOL III language, are described. Three methods are elaborated: 1/ based on vertical axis measurement of neutron flux and an assumption of thermal neutron point source. 2/ based on horizontal plane and vertical axis measurement of neutron flux. 3/ based on two horizontal planes measurement of neutron flux. Additionally a code for the determination of the extrapolation length is given. Author

N67-10523# Los Alamos Scientific Lab., N. Mex.

DOSE RATE MEASUREMENTS ON THE KIWI B-4D-202 AND KIWI B-4E-301 REACTORS

F. W. Sanders 18 Jul. 1966 21 p refs

(Contract W-7405-ENG-36)

(LA-3447) CFSTI: HC $1.00/MF $0.50

Gamma dose rates were measured at several distances from Kiwi reactors B-4D-202 and B-4E-301 during testing. Measurements performed were similar to those made on previous Kiwi reactors. Peak gamma dose rates of 3.17×10^4 and 3.22×10^4 R/min were measured at 60 feet from B-4D and B-4E, respectively. The eight Kiwi reactors tested have yielded rather uniform gamma dose rates per megawatt of reactor power; the average value is 35.1 R/min-Mw, measured at 60 feet. Author (NSA)

N67-10524# California Univ., Berkeley. Lawrence Radiation Lab.

BEVATRON OPERATION AND DEVELOPMENT. 47, JULY–SEPTEMBER 1965

Kenneth C. Crebbin and Robert Frias 22 Mar. 1966 19 p ref

(Contract W-7405-ENG-48)

(UCRL-16554) CFSTI: HC $1.00/MF $0.50

The Bevatron provided beam for physics research 84% of the scheduled operating time. The pole-face-winding power supply was modified to provide current regulation and to allow ramping the currents at injection. One primary experiment ended this quarter and four new primary experiments were started. A new system for motor control was installed on the main motor generator sets. The new system provides more versatile control of the motor generators and reduces the input line current variations caused by the pulsed load demand of the Bevatron. Author (NSA)

N67-10525# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

IMPROVED SERVICE-LIFE OF 15-KG REDUCTION REACTOR VESSELS

L. L. Nelson 6 Jun. 1966 19 p

(Contract AT(29-1)-1106)

(RFP-741) CFSTI: HC $2.00/MF $0.50

Reduction vessels used for bomb reducing batches of UF_4 to uranium metal were failing after approximately twenty-five runs. The failures were caused by progressive cracking around the inside of the top of the vessel. These vessels were centrifugally cast from Type-310 stainless steel. It was determined that the cracking was caused by sensitization from the thermal cycling to which these vessels were subjected. Sensitization resistant Type-347 stainless steel is now used for the reactors and no cracking was evident to fluorescent penetrant inspection. Author (NSA)

N67-10531# Los Alamos Scientific Lab., N. Mex.

CHARACTERISTICS OF THE AEROSOL PRODUCED FROM BURNING SODIUM AND PLUTONIUM

Harry J. Ettinger, William D. Moss, and Harold Busey 1 Jul. 1966 49 p refs

(Contract W-7405-ENG-36)

(LA-3491) CFSTI: HC $3.00/MF $0.50

Safety analysis of Na-cooled, Pu-fueled, fast reactor plants must be concerned with the possibility of fires involving these materials. Size characteristics of the aerosol produced during Na and Pu fires were determined for different atmospheres ranging from 20.8% O_2, 79.2% N_2 to 100% N_2. Gram quantities of

metallic Na, Pu-Co-Ce alloy, and alpha- and delta-phase Pu metal were burned separately. The aerosol produced by burning gram quantities of Na was compared with that produced by a fire involving 600 pounds of Na. Data were obtained regarding the fraction of Pu alloy airborne during a Pu fire. Fires simulating a reactor accident involving both fuel and coolant defined the relative airborne concentrations of Pu and Na. Author (NSA)

N67-10535# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT. 48. OCTOBER–DECEMBER 1965
Kenneth C. Crebbin 5 May 1966 17 p refs
(Contract W-7405-ENG-48)
(UCRL-16741) CFSTI: HC $1.00/MF $0.50

The beam was on for experimenters 87% of the scheduled operating time. Machine operation for five simultaneous experiments is discussed. A rubber gasket located near the external beam port was replaced; the gasket was damaged by radiation. Author (NSA)

N67-10537# TRW Equipment Labs., Cleveland, Ohio.
MERCURY RANKINE PROGRAM (SNAP 2). BOILER CONDITIONING: PHASE I RESULTS
Alfred Koestel 23 Jun. 1966 82 p refs Prepared for Atomics Intern.
(Contract AT(11-1)-GEN-8)
(NAA-SR-6322; ER-6660) CFSTI: HC $3.00/MF $0.75

The Phase I Boiler Conditioning Tests were conducted to investigate the effects of independent variables on mercury boiler deconditioning or conditioning. No extensive data reduction was performed, and only sample calculations were obtained. Results of the testing indicated that the causes of deconditioning are the result of subtle interconnections among various variables. Control of these variables, as a method of preventing deconditioning, would involve an extensive development program. In the boiler design, deconditioning can be controlled by minimizing the effect of these variables. Author (NSA)

N67-10539# Oak Ridge National Lab., Tenn.
THE ADEQUACY OF SCALE-UP IN EXPERIMENTS ON FISSION PRODUCT BEHAVIOR IN REACTOR ACCIDENTS. PART I: AN ANALYSIS OF SCALE-UP IN THE U.S. NUCLEAR SAFETY PROGRAM
C. E. Miller, Jr. and W. E. Browning, Jr. Jul. 1966 57 p refs
(Contract W-7405-ENG-26)
(ORNL-3901, pt. I) CFSTI: HC $3.00/MF $0.50

A study was performed to determine whether sufficient information bearing on fundamental principles and proved out by simulation on an adequate scale, is forthcoming from currently planned experiments in the U.S. Nuclear Safety Program on the behavior of fission products in a nuclear accident. Four areas of concern in nuclear safety experimentation are discussed: (1) release of fission products from the fuel, (2) transport of fission products from the fuel to the containment vessel, (3) behavior of fission products in containment systems, and (4) behavior of fission products in gas cleaning systems. Many small-scale experiments have provided a wealth of rather detailed data on these subjects. However, the application of these data to the prediction of the consequences of a nuclear accident requires extensive extrapolation. The validity of the extrapolation must be tested by determining whether under a specified set of conditions the mechanisms which are dominant in controlling fission product behavior are the same in large- and small-scale experiments. Large-scale experiments, such as the Loss-of-Fluid Test (LOFT), are planned in which a reactor core will be destroyed and fission product behavior will be determined. These experiments, because of their size, will be complex and costly and therefore few in number, and the application of their results to conditions not tested requires interpretation based on extrapolation from smaller-scale experiments. The need is discussed for additional intermediate scale experiments which could help test the validity of the extrapolations of the results of small-scale experiments and could provide more detailed information directly applicable to the events in a real nuclear accident than would be practical using the more costly full-scale experiments. We conclude that experiments to study fission product behavior in containment and in gas cleaning systems are well scaled over the range between small laboratory experiments and LOFT. However, experiments to study the release and the transport of fission products from fuels are not well scaled. Intermediate-scale experiments of the order of 10 and 1 percent of the size of LOFT are needed. Four such experiments are suggested. Author (TAB)

N67-10603# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
TWO-PHASE FLOW AND HEAT TRANSFER IN MULTIROD GEOMETRIES Quarterly Progress Report, 26 Jan.–25 Apr. 1966
May 1966 24 p refs
(Contract AT(04-3)-189)
(GEAP-5161; QPR-6) CFSTI: HC $1.00/MF $0.50

The flow structure in an eccentric annulus geometry with air and water flowing vertically upward was studied. Data on isokinetic sampling profiles, liquid-film flow rate, pressure drop, and average void fraction were obtained and are presented for one flow condition. Both single-phase air testing and two-phase air–water testing were successfully performed with the nine-rod air–water test section. Initial single-phase test section checkout tests were performed with air at test section pressures of 38 and 80 psig. A total of 370 local velocity measurements were made during single-phase testing. Two-phase testing was conducted at average mass qualities of 21.6% and 38%. Pressure drop data and isokinetic samples were taken at both qualities. Average void fraction, obtained with use of quick-closing valves, was found to be 95.5% at a quality of 38%. An indirect method of determining wall shear in two-phase flow is discussed, and preliminary results are presented. The method is an extension of that proposed by Preston in 1954 for single-phase flow. The method consists of correlating the measured pressure drop with the reading of a small impact tube placed on the tube wall. The preliminary results presented here show this method to be promising; further work is continuing. Author (NSA)

N67-10606# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
USAEC-AECL COOPERATIVE PROGRAM Monthly Progress Report, May 1966
H. S. Hilborn, comp. 10 Jun. 1966 12 p
(Contract AT(07-2)-1)
(DPST-66-83-5) CFSTI: HC $1.00/MF $0.50

Samples from the simulated burned-up fuel rods were chemically analyzed. There is several percent spread in the measured Pu/U ratios. More work is necessary to resolve these discrepancies. Substitution buckling measurements in the PDP were completed for two of the three host lattices. Temperature coefficient measurements in the SE were completed. Preliminary analyses indicate a negative coefficient at a 9.33-in. triangular pitch, and a coefficient close to zero at an 11.5-in. square pitch. The extensive SE foil measurements are on schedule. Analyses of hydride orientations in two series of specially fabricated Zircaloy tubing indicated that the hydride orientation directional strain parameter (D_cP) is an equilibrium relationship that develops after a moderate amount of fabrication processing and annealing. At least two fabrication steps with similar D_cP's followed by anneals appear to be necessary to obtain the equilibrium hydride orientation. As a corollary of this conclusion these data also show that tubing with a good fabrication history and a circumferential hydride orientation preference can undergo a light, low-D_cP finishing step without large changes in the fraction of rapidly oriented platelets. On the other hand the radial orientation produced by large amounts of

low-DrP processing can only be overcome with difficulty. Fabrication and installation of the rod for neutron flux monitoring in the reactor was completed and testing is in progress. Author (NSA)

N67-10607# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report, May 1966
30 Jun. 1966 99 p refs
(ANL-7219) CFSTI: HC $4.00/MF $0.75

Separate abstracts were prepared for the four included sections. NSA

N67-10611# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
NEUTRON SCATTERING BY HYDROGENEOUS MODERATORS
J. U. Koppel 22 Mar. 1966 76 p refs Presented at the Am. Nucl. Soc. Meeting on Neutron Spectra in Thermal and Resonance Reg., San Diego, Calif., Feb. 1966
(Contract AT(04-3)-167)
(GA-7055; CONF-660204-16) CFSTI: HC $3.00/MF $0.75

An analysis is presented on the state-of-the-art of calculating slow neutron scattering from liquid hydrogen, polyethylene, water, and zirconium hydrides, and comparisons are made between theoretical results and recent experiments. NSA

N67-10612# Brookhaven National Lab., Upton, N. Y.
NUCLEAR POWER REACTOR TECHNOLOGY
John C. Chen May 1966 86 p refs Presented at the 1966 Chinese Inst. of Engr. Sem., Taiwan
(Contract AT(30-2)-GEN-16)
(BNL-10309)

The current status and recent developments are reviewed for a number of the major types of power reactors. The reactor types discussed were selected on the basis of being either a well developed reactor type with substantial existing experience, or a prototype or concept which promises significant advances. In each case, a typical reactor is described to illustrate the characteristics of that particular class of reactors. Following that, recent significant developments and advances for that reactor class are reviewed to obtain some idea of the various versions that will likely evolve in the near future. NSA

N67-10620# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
YANKEE CORE EVALUATION PROGRAM Quarterly Progress Report, Period Ending 31 Mar. 1966
M. J. O'Boyle, comp. Jun. 1966 108 p refs
(Contract AT(30-1)-3017)
(WCAP-6080) CFSTI: HC $4.00/MF $0.75

Twelve cladding specimens from Phase I (14 Core I assemblies) and Phase II (one assembly cycled in Cores I and II) were burst-tested at elevated temperature (650°F). Although there was considerable scatter in the results, the expected trend to increased burst pressures with increased fast flux exposure was evident. Results from visual inspections and dimensional checks were evaluated for the intact Phase III fuel assembly and the eight individual Phase III fuel rods scheduled for further study. (Under Phase III, one of the original two Phase II assemblies was recycled again in Core IV.) These evaluations indicate that neither the extended in-core exposure (about three years) nor the high is shown to be optimum if the fuel density in its periphery is maximum allowed while the equality in thermal restriction is held in the central zone. Author (NSA)

N67-10629# Atomic Energy Establishment, Winfrith (England).
SPLOSH II: A DYNAMICS PROGRAMME FOR NUCLEAR-THERMAL-HYDRODYNAMIC BEHAVIOUR OF WATER-COOLED REACTORS
D. Moson Jan. 1966 70 p refs
(AEEW-R-441)

A dynamics code is described that solves the two-group neutron diffusion equations simultaneously with the thermal and the hydraulic equations for an average channel of a water-cooled reactor. Other reactor channels can be represented as slaves, which have no feedback to the average channel. The fission power at any axial station in a slave channel is related to that in the average by prescribed time-dependent factors, and the hydraulic flow is determined from pressure-drop requirements dictated by the performance of the average channel. A finite difference model of the fuel element and can represents the behaviour of the fuel temperatures and surface heat flux. The representation of the hydraulic circuit was made sufficiently general that the code is applicable to BWR, PWR, and pressure tube reactor designs. The code can be used to study transients resulting from imposed time variations in coolant flow, inlet enthalpy, system pressure, electrical torque supplied to the circulating pumps, (or alternatively, the angular velocity of the pump rotors,) moderator height, frictional resistances simulating blockages and control rod and fuel element insertions. The harmonic response can be obtained by injecting sinusoidal time variations until the starting transient has been damped out. Output includes axial distributions of the neutron fluxes, heat flux, coolant density and temperature, burnout margin, and the fuel and can temperature in both the average and the slave channels. The code was originally written in FORTRAN II for use on the IBM 7090. Computing times vary greatly with the problem and the desired accuracy, but experience has shown that a computing time which is slower than real time by a factor thirty is adequate for a wide range of cases. The code has recently been converted to S2 and EGTRAN for use on the IBM 7030 and the English Electric Leo Marconi KDF 9 computers. Author (NSA)

N67-10635# Stanford Research Inst., Menlo Park, Calif.
A METHOD OF ESTIMATING THE INTEGRATED THERMAL POWER PRODUCED IN A NUCLEAR POWER REACTOR (PHOTOVOLTAIC MONITOR) Final Report
E. M. Kinderman and Sheldon Softky 15 Mar. 1966 29 p refs
(Contract IAEA-298/RB)
(NP-16188)

Stanford Research Institute has developed a photovoltaic cell in combination with its integrator, as a potential monitoring system for the integrated power generated by power reactors. The photovoltaic cell consists of a piece of anodized tantalum, with a gold counterelectrode evaporated on the anodic insulating film. When this device is irradiated with gamma radiation, it generates a current in the same manner as an illuminated solar cell. Such a radiation monitor appears simple to use since the photovoltaic cell can be small and easily inserted deep into the shield, outside the reflector of a reactor, where gamma radiation is proportional to reactor power. The integrating device can be left in a more accessible spot for readout with wires connecting it to the detector. Such a photovoltaic-cell, current-integrator system was developed and tested by Stanford Research Institute for the International Atomic Energy Agency (IAEA), Division of Safeguards. The detectors are reasonably linear in current output vs gamma-radiation intensity; a commercial electrolytic type of current integrator adequately integrates current from the detectors; a method for fabricating detectors with adequate long term (over six months) stability and reliability in gamma radiation fields was developed.
Author (NSA)

N67-10655# Scanprocess A/S, Copenhagen (Denmark).
DESIGN STUDY OF AN EXPERIMENTAL LOOP WITH A MODEL OF A DOR COOLANT CHANNEL IN FULL SIZE

Per Andersen, Rolf Andersen, Vagn S. Pejtersen, and Morten Grenness (Elsinore Shipbuilding and Eng. Co., Ltd.) 1966 191 p refs Sponsored by Danish Atomic Energy Comm. Prepared jointly with Elsinore Shipbuilding and Eng. Co., Ltd.
(RISO-123)

A design study is presented on an experimental loop with a model of a deuterium-moderated organic-cooled fuel element and coolant channel of actual size. The purpose of the experiment was to test the mechanical performance of the fuel elementchannel and to use the loop as the outer part of a heat transfer experiment. The design study included description of the loop, description of the purification plant, preheating the loop, auxiliary systems for the experiment, flange sealing, materials, regulation, instrumentation, data for components, and price calculations. NSA

N67-10665# General Electric Co., San Jose, Calif.
SOME DESIGN AND IRRADIATION EXPERIENCE WITH CAPSULES FOR LONG, CERAMIC FUEL ELEMENTS
F. W. Knight, G. L. O'Neill, and S. A. Rabin Nov. 1965 38 p ref
(Contract AT(04-3)-189)
(GEAP-4870) CFSTI: HC $2.00/MF $0.50

Capsule 83A was designed primarily to study the potential for fission product plugging in a high-power fuel element of reference length in a Fast Ceramic Reactor (FCR) with its relatively high temperature and sharp temperature gradient at the upper fuel-blanket interface. The irradiation was terminated at about 20,000 Mwd/Mt peak burnup when an abnormally high temperature rise on the fuel cladding was recorded. A basic modification in capsule design was called for to prevent gas blanketing and burnout of the fuel in these high-burnup, fission-product-plugging tests having fuel of reference length. It was decided, therefore, to enlarge the liquid-metal-bond annuli to reduce the probability of gas blanketing and burnout. However, enlarging the annuli introduces coolant convection problems which were previously minimized with the thin-bond annuli. It was decided to capitalize upon, rather than resist, the convection tendency by designing a convection-circulating capsule. Author (NSA)

N67-10676# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
IN-REACTOR CREEP MACHINES
V. Fidleris, H. N. Isaac, and H. P. Koehler (Hawker Siddeley Can., Ltd.) May 1966 34 p refs Presented at the Intern. Symp. on In-pile Irradiation Equipment and Tech., Harwell, Engl., 10–12 May 1966 Prepared jointly with Hawker Siddeley Can., Ltd.
(AECL-2568; CONF-660521-2) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

A review is presented of the background experience on which the logical development of the in-reactor creep machine design was based. The transitions from the NRX reactor type machine (fast flux approximately 1×10^{13} n/cm^2, gamma heating in machine = 0.3 watts/g) to NRU reactor machine (fast flux approximately 5×10^{13} n/cm^2, gamma heating in machine = 3 watts/g) and the transition from manually operated single units to a fully automated, computer logged multi-test system are described. Methods of maintaining steady temperature and stress conditions and obtaining reproducible strain measurements in the micro-inch range are described. Information is also presented on the results of handling the complex system in the caves for specimen changing and recalibration of vital parts such as pneumatic strain gages and stress applying bellows, as well as changing of faulty components such as heaters, thermocouples and bellows. NSA

N67-10684# Oak Ridge National Lab., Tenn.
DETERMINATION OF THE POWER *vs* REACTIVITY FREQUENCY RESPONSE FUNCTION OF A POWER REACTOR, WITH APPLICATION TO THE HIGH FLUX ISOTOPE REACTOR
B. R. Lawrence 5 Jul. 1966 38 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1471) CFSTI: HC $2.00/MF $0.50

A description is given of a numerical technique for calculating the power vs reactivity frequency response function of a power reactor. The approach avoids the evaluation of transfer functions in an algebraic form. The space independent reactor kinetics model is used in conjunction with a general set of first order equations to represent the thermal performance of the reactor. Results obtained by applying the technique to the Oak Ridge High Flux Isotope Reactor indicate that the reactor operating at full power of 100 Mw with the flux controller off has a frequency response which peaks broadly at 10 cps with a $\delta P/P^0$ vs $\delta k/k^0$ gain of 140. Author (NSA)

N67-10692# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
THERMOELASTIC STRESS IN EPITROCHOIDAL CYLINDRICAL NUCLEAR FUEL ELEMENTS
J. J. Thompson Feb. 1966 16 p refs
(AAEC-TM-312)

The exact solution is obtained for the two dimensional thermoelastic stress problem of an epitrochoidal cylinder with uniform internal heat generation, for conditions of plane strain. Numerical values are given for the tangential stresses at the crests and troughs of the surface corrugations. Author (NSA)

N67-10701# Los Alamos Scientific Lab., N. Mex.
DISTURBANCE OF CAPACITIVE LIQUID LEVEL GAGES BY NUCLEAR RADIATION
Walter L. Willis [1966] 20 p refs Presented at the Cryog. Eng. Conf., Boulder, Colo.
(Contract W-7405-ENG-36)
(LA-DC-7654; CONF-660605-5) CFSTI: HC $1.00/MF $0.50

Liquid level in the dewars at the Nuclear Rocket Development Site is monitored by temperature profiles, carbon resistor point sensors, and capacitance gages which provide a continuous indication. The continuous nature of the capacitance gages led to heavy reliance on the indication of level provided during reactor tests. Incorrect behavior of these gages during tests in June of 1965 led to reactor damage. The major difficulty with the capacitance gage is the high impedance of the probe units. The excitation frequency and capacitance values yield impedances on the order of a megohm. If a low impedance system could be employed, radiation effects would become negligible. A solution to the problem appears to be a system called time domain reflectometry, or TDR. This system measures the characteristic impedance of a transmission line and detects the gas–liquid interface by the sudden change in impedance. In this system the characteristic impedance is approximately 50 ohms. Tests indicate that radiation does not disturb this system. It was concluded that capacitance gages cannot be relied upon for future operations when the reactor is at high power levels. For these intervals two systems will be used. One is a set of fixed point sensors. The other will be TDR. Author (NSA)

N67-10705# Lyon Univ. (France). Inst. of Nuclear Physics.
STUDY OF A TUBULAR DYNAMIC PINCH [ETUDE D'UN PINCH DYNAMIQUE TUBULAIRE]
Charles Maisonnier (Ph.D. Thesis) Jun. 1966 117 p refs In FRENCH
(LYCEN-6623)

It is shown that there is a critical energy for all fusion reactors without confinement or with marginal confinement and that the geometry of the crossed linear pinch seems to lead to the minimum critical energy. The dynamics of such a pinch are then studied in detail and the critical characteristics of voltage and energy of the energy source are deduced. It appears that the nonconfined machines appear technically unfeasible except perhaps in the form of microbonds. On the contrary, a marginal confinement

can be attained either by the use of magnetic fields by the order of 10^7 gauss or by the use of a dense auxiliary plasma acting by inertia. An experiment was made to verify some of these theoretical deductions and to study the possibility of deducing a pinch of very low radius and high density confined by inertia. In this experiment an electrostatic injector produced a thin tubular beam of $LiAlH_4$ powder in an enclosure under vacuum. Under the influence of an intense pulsed source of electromagnetic radiations, the powder emits weakly ionized hydrogen which is radially accelerated by the beginning of the discharge of a bank of fast condensers. Approximately 1 μsec later, the remaining solid grains are vaporized and ionized furnishing thus an impulse dense tubular plasma which, after acceleration by the current from the bank of condensers compresses and confines by inertia in the vicinity of the axis the hydrogen plasma previously produced. An axial magnetic field preestablished at 1000 gauss can be superimposed at will. The different measurement methods used (measurement of current and voltage, magnetic probes, ultrafast cinematography, measurements of X-rays and neutrons) show that a deuterium plasma of density 2×10^{16} ions/cm^3 and temperature near 4 kev was confined by inertia for 1 μsec by cold (20 ev) dense (3×10^{18} ions/cm^3) plasma, producing 3×10^7 neutrons per discharge. Author (NSA)

N67-10709# Oak Ridge National Lab., Tenn.
GAS-COOLED REACTOR PROGRAM Semiannual Progress Report, Period Ending 31 Mar. 1966
D. B. Trauger and G. D. Whitman Jul. 1966 244 p refs
(Contract W-7405-ENG-26)
(ORNL-3951) CFSTI: HC $6.00/MF $1.75

The development of coatings for nuclear fuel particles (particularly pyrolitic graphite coatings) used in the Gas Cooled Reactor and other advanced reactors, is described. Thermodynamic data for uranium and uranium oxide fuel systems are given. Irradiation testing or reactor components and materials are discussed; and technological data for the German pebble-bed reactor and the Fast Reactor are presented. Nuclear safety procedures regarding the handling and use of the fuels are also discussed. L.S.

N67-10715# Atomic Energy Commission Research Establishment, Riso (Denmark).
ELECTRICITY DIRECTLY FROM ATOMIC ENERGY [ELEKTRICITET DIREKTE FRA ATOMENERGIEN]
Erik Storm Pedersen 10 May 1966 36 p refs In DANISH
(RISO-M-399)

The production of electricity directly from atomic energy without the use of pumps or turbines is described. This is possible by the use of magnetohydrodynamic thermoelectric, and thermionic devices used in conjunction with a nuclear reactor or radioisotopes as heat sources. The principles of these three direct conversion methods are explained, and some of the problems to be solved before they become important as power sources are discussed. Present and future systems are described. Author (NSA)

N67-10723# Technische Hogeschool, Eindhoven (Netherlands).
THE STEADY-STATE AND DYNAMIC BEHAVIOR OF A BOILING WATER REACTOR Quarterly Progress Report, 1 Oct. 1965–1 Jan. 1966
1 Jan. 1966 21 p refs
(Contract EURATOM-030-64-1 TEEN)
(EURAEC-1674; EUR-2865; WW-016-R94; QPR-20) CFSTI: HC $1.00/MF $0.50

Measurements are described which were carried out using the 60 mm shroud. Results are given for steady state as well as non-steady state conditions and are compared with the results obtained from the 50 mm shoud. The flowrate tends to be larger and the void fraction to be lower at comparable conditions. The threshold of instabilities has moved to higher power. The effect of subcooling is similar to that observed for the 50 mm shroud. Transfer dunctions were measured at a saturation temperature of 200°C. Preliminary results of the analysis of the data were reported. The void fraction was plotted according to Zuber and Findlay, the two phase friction data according to Martinelli–Nelson. Author (NSA)

N67-10727# Institutt for Atomenergi, Kjeller (Norway). Research Establishment.
A STUDY OF SPACE-DEPENDENT TRANSFER FUNCTIONS
K. Haugset May 1966 30 p refs Presented at EAES Symp. on Advan. in Reactor Theory, Karlsruhe, Germany, 27–29 Jun. 1966 Supported by AEC
(KR-107; CONF-660624-1) CFSTI: HC $2.00/MF $0.50

Measurement of the spatial dependent transfer function was performed in the zero-power reactor NORA, using the oscillator rod method. Frequency range was from 0.03 cps to 120 cps, and large spatial effects were detected at high frequencies. The experimental results are compared with a theoretical model of the space-dependent transfer function. This model is based on spatial eigenfunction expansion. Two-group diffusion theory gives good agreement with experiment in the whole frequency range. Author (NSA)

N67-10785# IIT Research Inst., Chicago, Ill.
STUDIES OF REACTOR CONTAINMENT STRUCTURES Final Report
M. A. Salmon Jun. 1966 113 p refs
(Contract AT(11-1)-578)
(IITRI-578P22-15) CFSTI: HC $4.00/MF $0.75

The extent to which openings reduce the strength of containment vessels and the design of reinforcements are studied. Methods for the analysis of the response of spherical shell segments with rigidly reinforced openings are developed and limit analysis solutions are given for finding the strength of reinforcements. Results of tests on thin-walled cylinders and on flat plates with reinforced circular openings are compared with theory to determine the validity of the analytical methods developed. NSA

N67-10787# General Dynamics, San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science
THE INFLUENCE OF NEUTRON CROSS SECTIONS ON THERMAL REACTOR SPECTRA
J. R. Beyster and J. M. Naill 4 Apr. 1966 38 p refs Presented at Am. Phys. Soc. Conf. on Neutron Cross Sect. Technol., Washington, D. C., 22 Mar. 1966
(Contract AT(04-3)-167)
(GA-7072; CONF-660303-44) CFSTI: HC $2.00/MF $0.50

For many applications thermal reactor spectra must be predicted with accuracy. The thermal spectra are determined by the scattering and absorption properties of the reactor medium. Absorption cross section data are generally obtained from standard compilations while reliable scattering cross section information is more difficult to obtain. Procedures for generating these data for spectral calculations and the degree to which spectra can now be predicted in thermal reactor systems are discussed. Examples of spectral problems involving the quality of absorption and scattering cross section data are given. Other factors influencing the ability to calculate thermal reactor spectra are also presented. Author (NSA)

N67-10771# Bettis Atomic Power Lab., Pittsburgh, Pa.
PM-2A REACTOR VESSEL TEST: PHASE I
J. M. Monahan and P. A. Halpine Jul. 1966 82 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-604) CFSTI: HC $3.00/MF $0.75

The PM-2A Reactor Vessel Test is designed as a program to obtain direct confirmation of pressure vessel brittle fracture prevention criteria by testing a full-size irradiated reactor vessel. Phase I, which has been completed, obtained nondestructive test data with the primary objective of the prediction of brittle fracture

failure under the controlled conditions of the pressure–temperature testing to be conducted as Phase II. Dimensional, ultra-sonic, and liquid penetrant examinations were made to provide data for a detailed stress analysis. Analytical and nondestructive measurements of the ^{54}Mn residual activity peaks were also utilized to obtain the integrated neutron flux seen by the vessel. Author (NSA)

N67-10790*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASUREMENT OF EFFECTIVE DELAYED NEUTRON FRACTION FOR NASA ZERO POWER REACTOR I
Donald Alger, Wendell Mayo, and Robert Mueller Washington, NASA, Nov. 1966 38 p refs
(NASA-TN-D-3709) CFSTI: HC $2.00/MF $0.50 CSCL 18I

The effective delayed neutron fraction β_{eff} has been experimentally determined for each of three uranyl fluoride–water solution reactors in the NASA Zero Power Reactor I facility. The hydrogen to uranium 235 atom ratios R for the solutions in these measurements are 190, 473, and 565. The value of β_{eff} has been measured by the boron substitution method. Values for β_{eff} obtained are 0.0090 ± 0.0006, 0.0086 ± 0.0005, and 0.0082 ± 0.0004 for the respective atom ratios. Calculated values of β_{eff} are in reasonable agreement with the experimental results. Author

N67-10809# European Atomic Energy Community, Ispra (Italy). Engineering Dept.
COLLECTION AND ANALYSIS OF DATA ON THE LIFE-EXPECTANCY OF ORGANIC PLANT COMPONENTS
S. Capobianchi, J. P. Rougeau, and G. Volta May 1966 24 p refs
(EUR-2984.e)

A preliminary scheme is outlined for collecting and automatically handling operating data of organic reactor loop components. This scheme can be applied to other types of components as well. In the collection step, each plant is subdivided into loops and each loop into components. All of the loops and components constitute an inventory which is stored at the computation center and updated with the same frequency as the collection of the operating data. Operating data of each loop are automatically attributed to its components unless particular conditions for a given component are specified. Four groups of information are foreseen in the statistical analysis. These groups are respectively concerned with the components in the inventory, the loop operating data, the operating data of components classified by nature and type and the failure rate of the latter. Author (NSA)

N67-10827# Johns-Manville Research Center, Manville, N. J.
DEVELOP 1800-400F FIBROUS-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, 1 Mar.–30 Jun. 1966
J. O. Collins, W. G. Pusch, E. J. Davis, and R. H. E. Brailey 1 Jul. 1966 163 p refs
(Contract AT(30-1)-3633)
(ALO-3633-1; QPR-1)

The development and evaluation of fibrous type thermal insulation materials for use in radioisotopic power systems in the temperature range of 1800° to 400°F were studied. The theoretical heat transfer analysis of MIN-K-type insulations was completed, indicating in part methods to attain greater thermal efficiency. The initial screening of commercially available fibrous insulations was also completed, and candidates which should be considered further recommended. Thirty-five experimental MIN-K formulations were evaluated in part for handleability, strength, moldability, thermal conductivity, thermogravimetric analysis, and machinability. Processing techniques were a major concern. The equipment required for the final screening and detailed evaluation phases is described. NSA

N67-10837# Joint Inst. for Nuclear Research, Dubna, (USSR). Lab. of Theoretical Physics.
APPLICATION OF FALSE SOURCE METHOD TO HETEROGENEOUS NUCLEUS CALCULATIONS IN CYLINDRICAL GEOMETRY [PRIMENENIE METODA LOZHNYKH ISOTOCHNIKOV K RASCHETAM GETEROGENNOGO YADRA V TSILINDRICHESKOI GEOMETRII]
V. Lelek 1966 8 p refs In RUSSIAN
(JINR-P-2699)

Using Feinberg–Galanin's method the calculation of a heterogeneous kernel is made for a line source asymmetrically placed in a moderator of a cylindrical form. It is placed in vacuum or in another medium. These calculations show how the problem of critical size of a reactor with cooled rods is reduced to that of reactor consisting only of a moderator and line rod. Effective values η_{eff} and γ_{eff} (thermal constant) are introduced. Author (NSA)

N67-10838# Battelle Inst., Frankfurt am Main (West Germany). Isotope and Nuclear Technology Div.
EVALUATION ON STRUCTURAL DESIGN OF A NUCLEAR-FUELED THERMIONIC CONVERTER, PART I [DIE DIMENSIONIERUNG EINES MIT KERNENERGIE BETRIEBENEN THERMIONISCHEN KONVERTERS, TEIL I]
R. Guenther Apr. 1966 60 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-66-06)

A thermionic fuel element in-core type, cylindrical geometry, may be feasible eventually with nuclear fuels of today's technology, if the following properties are approximated: 8 w(e)/cm^2 surface area of the emitter; more than 8% efficiency; 0.3 w(e)/g fuel element; 10^{13} cm^{-2} sec^{-1} thermal neutron flux; 1 year operating time. Technical safety may be achieved when improved nuclear fuels are available. Some details are discussed. The properties of the nuclear-fueled heater are evaluated. Author (NSA)

N67-10842# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PRELIMINARY HYDRAULIC ANALYSIS OF THE CONCEPTUAL FFTF CERMET DRIVER FUEL ELEMENT DESIGN
G. J. Crandall Jul. 1966 68 p refs
(Contract AT(45-1)-1830)
(BNWL-264) CFSTI: HC $3.00/MF $0.75

The fuel element consists of a fuel rod bundle surrounded by a stainless steel liner. Fuel rod bundle and liner slip as a unit into the fuel element process tube. Spiral ribs are attached to the fuel element liner and they create a spiral channel annulus between the fuel element liner and procrss tube. A hexagonal honeycomb grid fuel rod spacer design is illustrated. Pressure loss due to fuel rod spacers is calculated by three techniques. Sodium flow rate through the annulus is determined as a function of annulus hydraulic parameters. Sodium leakage between annulus spiral channels and the strength of fuel rod spacer strips to withstand the fluid forces are analyzed. NSA

N67-10849# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NEUTRONICS CHARACTERISTICS OF SELECTED COMPACT FAST REACTORS
W. W. Little Jr. and R. W. Hardie Jul. 1966 25 p refs
(Contract AT(45-1)-1830)
(BNWL-283) CFSTI: HC $2.00/MF $0.50

The neutronics characteristics of $^{235}UO_2$–W, $^{233}UO_2$–W, and ^{239}PuN–W fueled fast compact reactors are described. The principal items studied are reactor criticality and fuel burnup. For the fuel compositions and void fractions considered, ^{233}U and ^{239}Pu fueled reactors require considerably less fuel than corresponding ^{235}U fueled reactors. All reactors considered are rather insensitive to changes in the refractory metal inventory. Author (NSA)

N67-10851# Atomic Energy Establishment, Winfrith (England).
A COMPARISON BETWEEN BURNOUT DATA FOR 19-ROD CLUSTER TEST SECTIONS COOLED BY FREON-12 AT 155 LB/IN^2(ABS), AND BY WATER AT 1000 LB/IN^2 IN VERTICAL UPFLOW
G. F. Stevens and R. W. Wood Jan. 1966 61 p refs
(AEEW-R-468) HMSO: 10s

Previous experiments on the Winfrith Freon Rig have produced scaling factors which relate these Freon experiments to the corresponding experiments in water with an accuracy of about 10%. It has also been found that the Freon rig is accurate, economical, and easy to use. The scaling factors so obtained have now been tested against data for 19-rod clusters which had previously been tested at Columbia University. The results of the rod cluster tests are presented in which comparison is made between Freon-12 and water for three test-sections which differ in the means of spacing the individual rods. All the test-sections were heated uniformly with respect to length, but had a radial flux depression of nominally 0.70/1.0. The results provide strong evidence that the scaling factor method using Freon-12 at 155 lb/in^2 (abs) is a useful technique for predicting the behavior at burnout of complicated test-sections cooled by boiling water at 1000 lb/in.^{2} with only one-eighteenth of the power required for the water experiment. In particular, the Freon tests reproduce closely the relative burnout powers previously measured in water. It has also been found that repeated rebuilding of a nominally unchanged cluster from the same components can produce burnout powers differing by ±6%. This new result illustrates the power and value of the Freon technique. Author (NSA)

N67-10858# Keuring van Electrotechnische Materialen, N. V., Arnhem (Netherlands).
AQUEOUS HOMOGENEOUS SUSPENSION REACTOR PROJECT. PART A: RESEARCH AND DEVELOPMENT Annual Report, 1965
1965 36 p refs
(NP-16168, Pt. A)

A research and development report is presented on irradiation of fuel in capsules and on the applicability of a fine fuel for a suspension reactor. NSA

N67-10859# Keuring van Electrotechnische Materialen, N. V., Arnhem (Netherlands).
AQUEOUS HOMOGENEOUS SUSPENSION REACTOR PROJECT. PART B: KSTR: DESIGN AND CONSTRUCTION Annual Report, 1965
1965 27 p
(NP-16168, Pt. B)

A report is presented on the development of the Kema Suspension Test Reactor. Included are designs of reactor systems and components, instrumentation, and construction. NSA

N67-10860# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
MULTIROD, FORCED-FLOW, TRANSITION AND FILM BOILING MEASUREMENTS
D. F. Kunsemiller Feb. 1966 83 p refs
(Contract AT(04-3)-189)
(GEAP-5073; EURAEC-1657) CFSTI: HC $3.00/MF $0.75

A three-rod geometry with a triangular pitch was used in tests to obtain heat transfer data at three mass flows (1×10^6, 0.5×10^6, and 0.25×10^6 lb/hr-ft^2), three pressures (1000, 600, and 1400 psia), and a quality range of 19 to 75 percent. The effects of rod spacing and finned heat transfer surface were studied for the above conditions. A new effect was introduced when it was discovered that in Geometry I the portion of the rod facing the unheated channel produced CHF (critical heat flux) data which was approximately 10 percent higher than the data from the portion of the rod facing another heated surface. The effect of Geometry II was to decrease this factor from 10 percent to 6.5 percent without a significant change of the CHF conditions of Geometry I. Over the range of test conditions, the size of the transition region was found to vary from 5 to 15 percent of the CHF. This is a slightly larger range than was observed in the single-rod tests but is still indicative of a stable flow pattern. As predicted by the single-rod tests, the heat transfer coefficients were found to exhibit a strong space dependence until a sufficient dry wall length was attained. Once this dry wall length was attained, a fully developed heat transfer coefficient independent of space was observed. The addition of fins to the rods decreased the maximum temperature oscillation by 40 percent and improved the fully developed heat transfer coefficient by 15 percent or more. Better fin effectiveness may be achieved by increasing the ratio of fin height to hydraulic diameter. A long-term demonstration test with the rods operating in transition and film boiling for 101 hours was completed successfully. The findings of this test and the others are reported in detail. Author (NSA)

N67-10910# General Electric Co., San Jose, Calif. Advanced Products Operation.
A DESCRIPTION OF FUEL AND OTHER CORE MATERIALS PROCURED FOR SEFOR CRITICAL EXPERIMENTS IN ZPR-III
M. L. Johnson Dec. 1965 32 p refs
(Contract AT(04-3)-540)
(GEAP-5133) CFSTI: HC $2.00/MF $0.50

Critical Experiments for the Southwest Experimental Fast Oxide Reactor (SEFOR) are being conducted in the Zero Power Reactor-III (ZPR-III) fast-flux critical assembly at the National Reactor Testing Station, Idaho. In the ZPR-III, core materials in the form of small blocks are loaded into the compartmented core structure. Stainless steel cans containing metal alloy (19.5 wt% Pu-78.0 wt% U-2.5 wt% Mo) and cans containing Na_2CO_3 were developed and procured to simulate the oxide fuel and Na in SEFOR. Sintered BeO blocks coated with Kel-F were also procured. Ni blocks were provided for reflector material, and Kel-F-coated Boral blocks simulated the B_4C radial shield annulus. Quantities, weights, and design features of these materials are described. Author (NSA)

N67-10912# General Electric Co., Pleasanton, Calif. Nuclear Technology Dept.
PLUTONIUM SUBCRITICAL EXPERIMENT PROGRAM. Quarterly Report, 1 Jan.–31 Mar. 1966
J. G. Carver Apr. 1966 18 p refs
(Contract AT(04-3)-189)
(GEAP-5148; QR-7; EURAEC-1658) CFSTI: HC $1.00/MF $0.50

The main pressure vessel of the pressurized water system, the core support structure, and the grid plates were received, assembled, and partially tested. A fission converter plate borrowed from ORNL was installed inside a new mounting designed to meet available space requirements. Work was started to reduce the perturbations introduced by beads in the fuel rods and previous lattice calculations were reviewed. Licensing and procurement of critical schedule items are discussed. NSA

N67-10913# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
STORED ENERGY AND INDUCTANCE IN TWO-DIMENSIONAL FIELDS
Richard A. Beth 20 May 1966 4p
(Contract AT(30-2)-GEN-16)
(BNL-10323; AADD-106) CFSTI: HC $1.00/MF $0.50

The energy stored per unit length in a constant gradient field is determined. NSA

N67-10915*# Nuclear Utility Services, Inc., Washington, D. C.
ENVIRONMENTAL SAFETY ASPECTS OF NUCLEAR ROCKET FLIGHT OPERATIONS Semiannual Progress Report, May–Oct. 1964

December 1964 64 p refs
(Contracts AT(11-1)-651; SNPC-6)
(NASA-CR-79870; NUS-208) CFSTI: HC $3.00/MF $0.75 CSCL 21F

The work conducted during this period is divided into two major categories: Ground Safety Program Activities and Flight Safety Program Activities. The Ground Safety activities include: NRDS effluent work; modification and application of the NURSE-1 computer program to the NRDS situation; NRDS Safety Advisory Panel activities; and a preliminary study of effluent decontamination. The Flight Safety activities include: those generated by assignment under the Radiological Effects Working Group; the examination and development of models for the description of particle velocities created by destruct action; and work on nuclear transient codes. Author (NSA)

N67-10920*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
STEADY-STATE-COUPLED FLUID FLOW AND HEAT CONDUCTION ANALYSIS OF A HEAT-GENERATING SOLID, AS APPLIED TO REACTOR DESIGN
A. Y. Lee Nov. 1965 25 p refs Presented at the Am. Soc. of Mech. Engr. Meeting, Chicago, 7–11 Nov. 1965
(Contract SNP-1)
(NASA-CR-79869; CONF-65110-29) CFSTI: HC $1.00/MF $0.50 CSCL 18I

A method of solution of the steady-state-coupled fluid flow and heat conduction analysis of a heat-generating solid body that is cooled by a fluid flow along parallel channels is described. The major objectives of the analysis are the determination of flow distribution, axial temperature rise and pressure drop of the coolant as well as the spatial temperature distribution of the solid material. The solution is applicable to any solid body of arbitrary geometry having axially and transversely varying heat generation rates.Calculation example for a long rectangular bar internally cooled along 12 parallel channels which are arranged in a square array is given. Results from this coupled analysis and that obtained from an isolated channel analysis are compared. The effects of plugged channels on the material temperature of this sample solid body are also discussed. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N67-10024# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
LARGE PERMANENT MAGNET SEMICIRCULAR BETA RAY SPECTROGRAPH
Jan Kormicki, Henryk Niewodniczanski, and Zbigniew Stachura May 1966 41 p refs Submitted for Publication
(Rept.-476/PL) CFSTI: HC $2.00/MF $0.50

A large permanent magnet semicircular beta ray spectrograph is described. The dimensions of the pole pieces are 1000×630 mm^2. The gap height is 60 mm. Detection of electrons occurs on photographic plate or by using G.-M. counters. Energy resolution is about 0.04 per cent. A brief description of the applied method is given. Examples of the use of the spectrograph are presented. Author

N67-10041# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF THE ACADEMY OF SCIENCES OF THE USSR, MECHANICS AND MACHINE BUILDING Selected Articles
26 Mar. 1966 135 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhun. i Mashinostr. (Moscow), no. 5, 1964 p 3–19, 25–32, 77–82, 108–116, 140–147, 157–167
(FTD-TT-65-1322; TT-66-62130; AD-637582) CFSTI: HC $4.00/MF $0.75

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5. DEVELOPMENT AND INTERACTION OF PLASTIC-ELASTIC WAVE LOADS IN A ROD OF FINITE LENGTH G. V. Litvinov p 59–67 refs (See N67-10046 01-32)
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8. PLOTTING SUPERSONIC FLOW AROUND SOLID BODIES BY MEANS OF PLANE SHOCK WAVES G. I. Maikapar p 83–88 refs (See N67-10049 01-01)
9. RESISTANCE OF AN OBLIQUE LEADING AIRFOIL EDGE AT HYPERSONIC VELOCITIES V. V. Keldysh p 89–94 refs (See N67-10050 01-01)
10. THE AFFECT OF THE RATE OF THERMAL DEGRADATION ON THE PROCESS OF NON-STATIONARY DETERIORATION OF FIBER GLASS REINFORCED PLASTIC Yu. V. Polezhayev p 95–104 refs (See N67-10051 01-18)
11. DETERMINATION OF CORRECTIVES FOR READINGS OF TOTAL HEAD NOZZLES IN SUPERSONIC FLOW OF RAREFIED GAS V. A. Sukhnev p 105–113 refs (See N67-10052 01-12) N67-10050 01-01)
12. DEVELOPMENT OF WAVES ON THE SURFACE OF FILMS OF VARIABLE VISCOSITY UNDER A GAS FLOW E. V. Semenov p 114–118 refs (See N67-10053 01-12)

N67-10096# Library of Congress, Washington, D. C. Aerospace Technology Div.
FOREIGN SCIENCE BULLETIN, VOLUME 2, NO. 9
Sep. 1966 69 p refs

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1. SUNSHINE ON TAP: THE FOCON Z. Litynski p 1–20 refs (See N67-10097 01-23)
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9. SATELLITE AND METEOR TRACKING p 48–50 refs
10. SEMINAR ON MULTIPLE REFLECTED WAVES p 51–55 ref
11. ALEKSANDR MIKHAYLOVICH PROKHOROV (USSR) p 56–59 ref

N67-10097# Library of Congress, Washington, D. C. Aerospace Technology Div.
SUNSHINE ON TAP: THE FOCON
Zygmunt Litynski *In its* Foreign Sci. Bull., Vol. 2, No. 9 Sep. 1966 p 1–20 refs (See N67-10096 01-23)

A brief account is given of recent Soviet research on light conductors, particularly the focon. It is shown that, even though Soviet studies are mainly based on the work of Kapany in the United States, the Russians are also developing original ideas aiming at the application of conic lightguides to solar concentrators. Author

N67-10139# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ON THE PROPAGATION OF ION ACOUSTIC SOLITARY WAVES OF SMALL AMPLITUDE
Haruichi Washimi and Tosiya Taniuti Aug. 1966 7 p refs
(IPPJ-51) CFSTI: HC $1.00/MF $0.50

It is shown that under certain approximations the basic system of equations governing the propagation of ion acoustic waves can be reduced to the Kortweg–deVries equation. Author

N67-10148# Philips Gloeilampenfabrieken N. V., Eindhoven (Netherlands).
COLOUR CENTRES IN BORATE, PHOSPHATE AND BOROPHOSPHATE GLASSES
P. Beekenkamp [1966] 123 p refs *Its* Res. Rept. Suppl. no. 4, 1966
CFSTI: HC $4.00/MF $0.75

Radiation-induced color centers (flaws) in borate, phosphate, and borophosphate glasses were studied by optical-absorption and electron-spin-resonance measurements. Models, correlated to various structural units present in the glasses, are proposed to account for the properties of the color centers. In the borate glasses, there are at least two types of color centers; they are described as: an electron hole captured on the oxygen ions of a BO_4 group, and a pair of electrons captured on a non-bridging-oxygen vacancy. Three types of color centers are found in the phosphate glasses: an electron hole captured on a singly bonded, non-bridging oxygen ion, an electron hole captured on an oxygen ion bonded to a phosphorus and a metal ion, and a pair of electrons captured on a doubly bonded, non-birdging-oxygen vacancy. It is considered that the color centers found in the borophosphate glasses are of the same nature as those found in the borate and phosphate glasses. R.U.

N67-10179# Adelphi Univ., Garden City, N. Y. Dept. of Mathematics.
DISPERSION RELATIONS, STORED ENERGY AND GROUP VELOCITY FOR ANISOTROPIC ELECTROMAGNETIC MEDIA
Herbert Kurss Sep. 1966 29 p refs
(Grant NSF GP-2761)
(AGM-129)

The Hermitian and skew-Hermitian components of the susceptibility matrix of a general linear electromagnetic medium are represented as Hilbert transforms of each other. These so-called dispersion relations lead to a priori inequalities which must be satisfied by the susceptibility of a passive medium in a frequency interval in which the medium is lossless. One such inequality states that the stored energy density for a given $E(\omega)$ and $H(\omega)$ is always greater than in free space. This is also verified directly from the usual gyrotropic susceptibilities of ferrites and plasmas. The group velocity for an eigenwave or mode of a structure with one, two, or three independent translational symmetry vectors is shown to be, in general, an average Poynting vector divided by an average stored energy density. This formula is then combined with the above inequality for the stored energy density to show that the magnitude of the group velocity is less than the velocity of light in free space. Author

N67-10235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL INVESTIGATION OF CHARGING SUBMICRON CARBON POWDER FOR COLLOIDAL PARTICLE THRUSTORS
Ronald J. Schertler and Carl T. Norgen Washington, NASA, Oct. 1966 20 p refs
(NASA-TN-D-3657) CFSTI: HC $1.00/MF $0.50 CSCL 21C

The average charge-to-mass ratio of submicron carbon powder charged in a parallel plate system was determined by using a quadrupole mass filter, which permitted coverage of the range from 10^{-3} to 10^{7} coulombs per kilogram. A high intensity, low charge-to-mass ratio peak and several low intensity, high charge-to-mass ratio peaks were found. The average charge-to-mass ratio was about 10^{-1} coulonb per kilogram for an applied field of 10^{5} volts per meter. Results were compared with theory. Extrapolating these results to obtain an estimate of the effects of a field of 10^{7} volts per meter indicated that unreasonably high accelerating potentials would still be necessary to obtain useful specific impulses for colloidal thrustors. Author

N67-10286# Santa Clara Univ., Calif. Dept. of Physics.
PARAMAGNETISM OF CARBAZYL AND HYDRAZYL RADICALS Final Report
W. Duffy, Jr. and D. L. Strandburg [1965] 27 p refs
(Grant Nonr(G)-00058-63)
(AD-636388) CFSTI: HC $2.00/MF $0.50

Static magnetic susceptibility measurements in the temperature range 1.4–300°K are reported on powder samples of the stable aromatic free radicals picryl-n-aminocarbazyl (PAC), 2,2-diphenyl-1-picryl-hydrazyl in the 106°C m.p. (DPPH I) and 137°C m.p. (DPPH II) crystal modifications, 2-phenyl-2-p-nitrophenyl-1-picrylhydrazyl ($DHNO_2$) and 2,2-bis-p-nitrophenyl-1-picrylhydrazyl ($DHNO_2$) ($D(NO_2)_2$). Radical concentrations in the range from 0.81 to 0.99 and Weiss constants in the range −36°K to −5.2°K were determined. The measurements were interpreted assuming that the magnetic behavior is due to alternating antiferromagnetic exchange-coupled linear chains. Exchange integrals were inferred from fitting theoretical curves to the susceptibility maxima. Evidence is presented for the presence of random dilution by diamagnetic sites in PAC. Author (TAB)

N67-10291# Naval Research Lab., Washington, D. C.
THE EMISSION SPECTRA OF VARIOUS THERMOLUMINESCENT MATERIALS Interim Report
S. G. Gorbics 5 Aug. 1966 14 p refs
(NRL-6408; AD-638495) CFSTI: HC $1.00/MF $0.50

The thermoluminescence emission spectra of various materials were determined using a quartz-prism spectrograph. The materials studied include: CaF2:Mn, CaSO4:Mn, $Li_2B_4O_7$:Mn, LiF(TLD-100), CaF2(MBLE), and a terbium-activated lithium-aluminosilicate thermoluminescent glass. The spectra were measured photographically and corrected by means of an NBS quartz-iodine tungsten-filament standard of spectral irradiance. Precautions were taken to prevent spectral distortions resulting from the variation in sensitivity of the film as a function of wavelength, and from reciprocity-law failure. The present spectra are in general agreement with earlier measurements for CaF2:Mn, CaSO4:Mn, LiF(TLD-100), and CaF2(MBLE). The radioluminescence spectra of CaF2:Mn and CaSO4:Mn was determined and found to be similar in shape

and peak position to the thermoluminescence spectrum but were narrower. The radioluminescence spectrum of LiF(TLD-100), however, was wider than the thermoluminescence spectrum. The radioluminescence spectra of CaF2(MBLE) extended far into the ultraviolet region. Author (TAB)

N67-10309# Pomona Coll., Claremont, Calif. Dept. of Physics.
PRECISE DETECTION AND MEASUREMENT OF KERR MAGNETO-OPTIC ROTATIONS
Charles A. Fowler, Jr. 25 Aug. 1966 14 p refs
(Contract Nonr-1606(00))
(TR-10; AD-638211) CFSTI: HC $1.00/MF $0.50

A new photoelectric apparatus for sensitive detection and precise measurement of magneto-optical rotations is described. The device, utilizing two photomultiplier tubes in a balanced d.c. bridge circuit, operates at a higher light level than those previously employed and provides a larger magnetization signal and an improved signal-to-noise ratio. The reported data show that rotations as small as 5 sec of angle are readily detected and those of a few minutes of angle (characteristic of the longitudinal Kerr effect) can be measured with a precision of a few seconds. Author (TAB)

N67-10316# Yeshiva Univ., New York. Belfar Graduate School of Science.
SOME COMMENTS ON THE ONE-DIMENSIONAL MANY-BODY PROBLEM
Elliott Lieb [1965] 26 p ref Presented at the 4th Eastern Theoret. Phys. Conf., Stony Brook, N. Y., 26–27 Nov. 1965
(Grant AF-AFOSR-508-66)
(AFOSR-66-1574; AD-637834) CFSTI: HC $1.00/MF $0.50

In the first half, the implication and significance of one dimensional models for many-body physics is discussed. In the second part, a brief historical survey is given of existing models and results obtained to date. Author (TAB)

N67-10340# Columbia Univ., New York. Dept. of Electrical Engineering.
PERTURBATION ANALYSIS OF AXIALLY DEPENDENT ELECTROMAGNETIC STRUCTURES Scientific Report No. 91
Stephen L. Richter, Paul Diament, and S. Perry Schlesinger 15 Jan. 1966 94 p refs
(Contract AF 19(628)-2461)
(AFCRL-66-421; AD-637802) CFSTI: HC $3.00/MF $0.75

The previously developed iterative perturbation analysis, using nonlinear phase progression, for dealing with axially dependent perturbations on an otherwise axially uniform structure is applied to general electromagnetic propagation problems. Maxwell's equations for linear, time invariant media having arbitrary inhomogeneities and anisotropies are shown to be in proper form for application of the perturbation technique. The theory is applied to scattering from dielectric obstructions partially filling a waveguide. The shape and permittivity of an inhomogeneous tapered section are optimized together to achieve minimum reflection for a given phase shift through the dielectric material. Applications of the perturbation technique to the calculation of radiation from parasitic arrays excited by surface waves are discussed. Such problems have been previously solved by utilizing the phase progression of only the original surface wave and ignoring the element pattern. The present technique straightforwardly takes into account the changes in phase progression due to the parasitic elements, and the element pattern is automatically included in the computation of the total radiation pattern. Author (TAB)

N67-10425# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
EQUATION OF MOTION FOR A ROTATING OR NONROTATING SPACE VEHICLE CONTAINING PASSIVE MOVING PARTS
George Zetkov Nov. 1965 29 p ref
(ADR-08-07-64.3)

A mathematical model is developed for a rotating or nonrotating space vehicle containing passive moving parts. The equations of motion are solved for the vehicle attitude, and also for the positions of the passive moving parts. The mathematical model includes: (1) the effects of external moments and forces; (2) the effects of motions of other passive moving parts upon the motion of the passive moving part under consideration; (3) the effect of mass expulsion or accummulation; and (4) the effect of the center of mass offset from the center of the body reference axes. Author

N67-10426*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
EXPANSION IN SPHERICAL HARMONICS. IV: INTEGRAL FORM OF THE RADIAL DEPENDENCE
R. A. Sack (Roy. Coll. of Advanced Technol.) 16 Sep. 1966 41 p refs
(Grant NsG-275-62)
(NASA-CR-79830; WIS-TCI-188) CSCL 20J

A function $f(r_{AB})$ $Y_l^M(\theta_{AB}, \phi_{AB})$ of a vector $r_{AB} = \Sigma_i$ can be expanded in spherical harmonics $Y_l^m(\theta, \phi)$ of the directions of the individual vectors. The solutions are found as multiple integrals over the product of Legendre polynomials and of a function G(W) where W depends linearly on the η_i. The kernel G(W) is independent of the number of constituent vectors, their relative sizes and the orders of their harmonics; it contains the Heaviside step function H(W) as a factor which takes care of the various regions. The precise form of G can be found from f and L by an integral equation which for L=0, 1 is solved for arbitrary f, and for L>1 for sufficiently large positive powers. The explicit expressions for the angle average can be obtained simply by repeated integration of $G(\omega)$ or directly from the differential equations. For the inverse distance between two points $G(\omega)$ becomes Dirac's delta function; the number of integrations is thereby reduced by one. Author

N67-10440# Massachusetts Inst. of Tech., Cambridge.
ON THE OPTIMAL ERROR REGULATION OF A STRING OF MOVING VEHICLES
William S. Levine and Michael Athans 1 Oct. 1965 29 p refs Presented at 1966 JACC Meeting Submitted for Publication
(Contract C-85-65)
(ESL-P-251)

This paper uses the thory of optimal control to design an optimal linear feedback system which regulates the position and velocity of every vehicle in a densely packed string of high-speed moving vehicles. In addition to the general theoretical formulation and solution of the optimization problem, analog computer simulation results are presented for the case of a string of three vehicles. Author

N67-10463# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer energiewandlung und Elektrische Antriebe.
TABLE AND GRAPHICAL REPRESENTATION OF THE NORMALIZED MAGNETIC AND ELECTRIC FIELD STRENGTHS OF A CURRENT LOOP [TABELLE UND GRAPHISCHE DARSTELLUNGEN DER NORMIERTEN MAGNETISCHEN UND ELEKTRISCHEN FELDSTAERKEN EINER STROMSCHLEIFE]
Armand Meert Nov. 1965 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-65-51; DVL-423) CFSTI: HC $2.00/MF $0.50

The magnetic field configuration of a current loop, as well as the electric field configuration caused by temporal change of the magnetic field, may be derived by means of dimensionless geometrical coefficients which are functions only of the normalized coordinates of the space point. The report contains tables and graphs of these coefficients as functions of cylinder coordinates normalized on the loop radius. The calculated magnetic figure is also represented. Author

N67-10464# Technisch Physische Dienst TNO-TH, Delft (Netherlands).

EXPERIMENTS ON THE RELIABILITY OF ACOUSTICAL SCALE MODELS. SIMPLE STEELS SECTIONS WELDED OR GLUED

P. C. Williams 11 Aug. 1966 29 p

(TDCK-46297; Rept.-608.132 III) CFSTI: HC $2.00/MF $0.50

Use of continuous welds in ship models is both time consuming and difficult. Comparisons have thus been made between the acceleration response of simple steel sections continuously welded (prototypes) and sections spot welded together with glue (models) when excited by an underwater source. This response has been used as the criterion for acoustical reliability of models to prototypes. The response of the models does not follow that of the prototypes although the deviations are not entirely unsatisfactory. Use of additional stiffeners in model construction makes a better agreement conceivable. Author

N67-10465# Technisch Physische Dienst TNO-TH, Delft (Netherlands).

EXPERIMENTS ON THE RELIABILITY OF ACOUSTICAL SCALE MODELS MODIFIED SECTIONS

P. C. Williams 19 Aug. 1966 14 p refs

(TDCK-46298; Rept.-608.132 IV) CFSTI: HC $1.00/MF $0.50

Prototype steel sections were constructed either by continuous welding or by a spot weld and glue combination. Acoustical reliability testing of the samples showed that components constructed by the combined method displayed slightly different transmission characteristics than its less accurate predecessor by showing a lower response at lower frequencies and a higher response at higher frequencies. The use of small angle plates as junction stiffeners increased acceleration response by an amount up to 2 dB throughout the test frequency range. The model displayed greater damping effects than the prototype. G.G.

N67-10490# Signatron, Inc., Lexington, Mass

OPTICAL IMAGE DETECTION THROUGH A TURBULENT ATMOSPHERE Interim Report

Robert S. Kennedy Griffiss AFB, N. Y., RADC, Aug. 1966 48 p refs

(Contract AF 30(602)-3561)

(RADC-TR-66-405; AD-638613) CFSTI: HC $2.00/MF $0.50

The problems of detecting and matching noisy optical and infrared images viewed through a turbulent atmosphere are discussed from the vantage point of modern decision theory. It is noted that the structure of the optimum image processor varies significantly with the statistics of the noise and of the images. A first moment approach is also presented for use when a decision theory approach is not feasible. The classical correlator is encountered in both approaches but its optimality is restricted to a limited class of problems. The average influence of the atmosphere is then reviewed and a preliminary model for the time variation of this influence is developed Author (TAB)

N67-10502# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.

STRESS WAVES AND PENETRATION Final Report, 1 Jan. 1963–15 May 1966

Norman Davids 15 May 1966 121 p refs

(Contract DA-31-124-ARO(D)-67)

(AROD-3842-7; AD-637828) CFSTI: HC $4.00/MF $0.75

A basic theoretical research program in stress waves and penetration mechanics, with particular emphasis on armor plate, is described. The contents of this report include (1) list of output documents, (2) general summary and review of project activities, (3) Progress of last 6 months period, and (4) technical work of significance not previously reported. Author TAB

N67-10511# Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

THE RESPONSE OF SOILS TO DYNAMIC LOADINGS. REPORT NO. 24: WAVE VELOCITIES THROUGH PARTIALLY SATURATED SAND-CLAY MIXTURES

H. A. Balakrishna Rao Mar. 1966 62 p refs Soils Publ.-194

(Contract DA-22-079-ENG-224)

(R66-13; AD-638027) CFSTI: HC $3.00/MF $0.75

Investigations concerning the velocity of dilatational and shear waves through compacted specimens of kaolinite and kaolinite-sand mixtures at different moisture contents have been described. The delay time between the input and output signals from piezoelectric crystals located at the two ends of compacted samples has been utilized to evaluate the wave velocity. The results reveal that there are two important parameters involved in the propagation of dilatational waves: confining stress and moisture content. An increase in confining stress tends to increase the dilatational wave velocities. An increase in the moisture content also tends to increase the dilatational wave velocity, particularly at high saturation. The magnitude of wave velocity measured in various mixtures is similar to those in dense sand. The results of shear wave tests show a reduction of shear wave velocity with increase in moisture content. The decrease is attributed partly to the decrease in the rigidity of the fabric and partly to addition of mass which contributes to the inertia force. For a constant dry density, the presence of sand tends to decrease the wave velocity, apparently because differing amounts of sand required different compactive efforts Author (TAB)

N67-10568# Aktiebolaget Atomenergi, Stockholm (Sweden).

VOID MEASUREMENTS IN THE REGIONS OF SUB-COOLED AND LOW-QUALITY BOILING. PART 2: HIGHER MASS VELOCITIES

S. Zia Rouhani Jul. 1966 61 p refs

(AE-239) CFSTI: HC $3.00/MF $0.75

Tables of experimental data obtained in void measurements are presented. The data are from measurements in a vertical annular channel with 25 mm o.d. and 12 mm i.d. at a heated length of 1090 mm. These experiments covered pressures from 10 to 50 bars, mass velocities from 650 to 1450 kg/m^2/s, heat fluxes from 60 to 120 W/cm^2, subcoolings from 30° to 0°C, and steam qualities from 0% to 12%. The tables include the inlet temperatures and measured wall superheat. Author

N67-10572# Technisch Physische Dienst TNO-TH, Delft (Netherlands).

SCALING RULES FOR ACOUSTIC MODELS

T. ten Wolde 18 Jul. 1966 refs

(TDCK-46172; Rept.-608.132 II) CFSTI: HC $1.00/MF $0.50

Model rules for application to investigating the sound radiation from a ship to the surrounding water are derived and discussed. The assumptions involved are delineated, and the model rules are derived by tracing which physical factors might play a part and employing dimensional analysis. The model rules derived are then discussed, including geometrical similarity, model frequency, density, real part of the constants of elasticity, damping, and gravity. It was concluded that most of the model rules for acoustical model experiments can be easily satisfied if the same materials are used in the model as in the prototype. Further research was recommended concerning the influence on the sound transmission of the following

items: damping, limited dimensions of the model, deviating junctions, and simplifications of the model. L.E.W.

N67-10675# Southampton Univ. (England). Inst. of Sound and Vibration Research.
THE THEORETICAL ROLLING MOMENT CAPACITY OF MEGNETICALLY SUSPENDED SHAPED CORES
M. J. Goodyer Feb. 1966 34 p
(ISAV-140) CFSTI: HC $2.00/MF $0.50

In order to control the rolling motions of magnetically suspended wind tunnel models, shaped magnetic cores were used within the model to generate rolling moments under the action of the magnetic fields generated by the controlled electromagnets comprising the suspension system. The theoretical moment generating performance of some shaped cores is given. The effect of the design of the cross section of the core is discussed, and an optimum cross sectional shape is proposed. Author

N67-10656# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
ACCURACY OF RESONANCE PARAMETERS FROM COMBINED AREA AND SELF-INDICATION MEASUREMENTS
F. H. Froehner, E. Haddad, W. M. Lopez, and S. J. Friesenhahn 27 Apr. 1966 15 p refs Presented at the Am. Phys. Soc. Conf. on Neutron Cross Sect. Technol., Washington, 22 Mar. 1966
(Contract AT(04-3)-167)
(GA-7060; CONF-660303-43) CFSTI: HC $1.00/MF $0.50

The information which can be obtained from measured transmission areas, capture areas, scattering areas, and self-indication ratios is studied by means of the analysis curves (I'_n versus I'_γ). It is shown that the character of the curve intersections, and thus the accuracy of the calculated resonance parameters, depends mainly on the strength of the resonance ($I'_n : I'$). Universal analysis curves are plotted for thin and thick samples, and for strong, intermediate, and weak resonances. The curves readily indicate which obserables should be used, and roughly what accuracies may be expected for the various cases. Author (NSA)

N67-10683# International Centre for Theoretical Physics, Trieste (Italy).
DISCRETE SERIES OF HERMITIAN REPRESENTATIONS OF THE LIE ALGEBRA OF U(p,q)
I. T. Todorov Jun. 1966 36 p refs
(IC-66/71)

The method of Gel'fand and Graev is described for the construction of the discrete series of hermitian representations of the Lie algebra of U(p,q). A generalization of the original Gel'-fand–Graev prescription is proposed to include the most degenerate discrete series in the set under consideration, but still no complete description of all discrete hermitian representations of the algebra is given. Three of the most degenerate discrete series which seem to be of physical interest are treated in more detail both by the generalized Gel'fand–Graev method and in terms of creation and annihilation operators. Author (NSA)

N67-10702# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Theoreticheskoi i Eksperimental'noi Fiziki.
INTERACTIONS AT HIGH ENERGY (THEORY OF COMPLEX MOMENTS AND EXPERIMENT) [VZAIMODEISTVIE PRI VYSOKOI ENERGII (TEORIYA KOMPLEKSNYKH MOMENTOV I EKSPERIMENT)]
K. Ter-Martirosyan 1966 121 p refs In RUSSIAN; ENGLISH summary
(Rept.-417)

The experimental data on particle interactions at high energy (up to $E_{lab} \approx 30$ Bev) are considered using the complex momenta theory and its simplest form–Regge pole model. It is shown that all the data available are in good agreement with the theory. NSA

N67-10711# National Inst. for Research in Nuclear Science, Harwell (England). Rutherford High Energy Lab.
FEASIBILITY STUDY OF A 15 TO 70 MeV SEPARATED ORBIT CYCLOTRON AS A BOOSTER INJECTOR
F. M. Russell, ed., R. W. Branfield, R. Billinge, J. H. Coupland, J. C. Louth et al Jun. 1966 89 p refs
(RHEL/R-122) HMSO: 12s

A feasibility study was made on a separated orbit cyclotron (SOC) for use as a booster injector for Nimrod. The design and economics aspects of the SOC were considered. NSA

N67-10713# National Inst. for Research in Nuclear Science, Harwell (England). High Magnetic Fields Group.
ESTIMATES OF RADIATION DOSE RATES FOR SUPERCONDUCTING MAGNETS
J. D. Lewin Feb. 1966 17 p refs
(RHEL/R-118) HMSO: 2s 6d

The possible effects of irradiation on superconducting magnets are listed, and the radiation doses magnets may be subjected to in high energy physics applications are estimated, as a guide to the experiments which will be necessary to determine the suitability of superconductors to these applications. The heating of a of superconducting magnet by radiation is calculated, and the limitations imposed by the resulting increase in superconductor temperature are discussed. The results are summarized in a form which should prove generally useful in the estimating of approximate radiation levels in the vicinity of particle accelerators. While these results apply to proton machines only, it seems that values for electron machines should not be substantially different. Author (NSA)

N67-10714# Case Inst. of Tech., Cleveland, Ohio. Nuclear Physics Lab.
ELECTROMAGNETIC SCATTERING OF CHARGED PARTICLES WITH SPIN
Jonas T. Holdeman, Jr. (Ph.D. Thesis) Jun. 1966 121 p refs
(Contracts AT(11-1)-720; AT(11-1)-1573)
(COO-1573-1) CFSTI: HC $4.00/MF $0.75

The effect of the anomalous magnetic moment of charged particles in electromagnetic scattering is studied. The coulomb interaction is treated exactly, while the phase shift due to the interaction of the magnetic moment with the coulomb field is treated in the distorted wave Born approximation. These phase shifts are found from the Schrödinger equation with relativistic corrections and from the Dirac equation with a Pauli moment interaction. The expressions for the two scattering amplitudes in terms of the phase shifts are examined. For several cases these amplitudes are calculated numerically, along with the electromagnetic polarization. The results are compared with other approximations. Author (NSA)

N67-10728# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
SUPERCONDUCTING AG SYNCHROTRON MAGNETS
P. F. Dahl, K. Jellett, and G. Parzen 25 May 1966 11 p refs
(Contract AT(30-2)-GEN-16)
(BNL-10297) CFSTI: HC $1.00/MF $0.50

The design of superconducting magnets differs from that of conventional iron magnets in that the shape of the magnetic field is determined primarily by the current distribution rather than by the presence of the iron pole face. The problem of finding current distributions to obtain the magnetic field desired in AG synchrotron magnets was investigated. The results are discussed. NSA

N67-10730# International Centre for Theoretical Physics, Trieste (Italy).
A NEW FAMILY OF SUM RULES FROM CURRENT ALGEBRA

D. Amati, R. Jengo (Trieste Univ.), and E. Remiddi Jul. 1966 10 p refs Submitted for Publication
(IC-66/86)

A new family of sum rules based on the algebra of currents is proposed and some of its physical implications discussed. NSA

N67-10773# Commissariat a l'Energie Atomique, Saclay (France). Departement d Electronique Generale.
THEORETICAL STUDY OF A RANDOM PROCESS DERIVED FROM A POISSON PROCESS BY DIVISION [ETUDE THEORIQUE D'UN PROCESSUS ALEATOIRE DERIVE D'UN PROCESSUS DE POISSON PAR DIVISION]
Jacques Freycenon Mar. 1966 46 p refs In FRENCH
(CEA-R-2907)

The time distribution of impulses issuing from a scaler (the "divider") is studied when the input consists of impulses obeying a Poisson distribution. The variance of a single counting and the correlation between successive countings are computed. One derives then the autocorrelation function and spectral density of the instantaneous counting rate at the divider output. These results are applied to the Fourier analysis of the periodic sampling of the number of impulses issuing from the divider. It is shown that if one tries to increase the information rate received in the sampling device by mixing the impulses coming from several detectors, he can lower, by division, the mean counting rate of the sum signal without practically losing information. The division must take place after mixing but not before. Author (NSA)

N67-10822# Commissariat a l'Energie Atomique, Saclay (France). Sections des Mesures Neutroniques Fondamentales.
STUDY OF THE FREQUENCY MODULATION OF VARIOUS UHF SIGNALS OCCURRING IN AN ELECTRON LINEAR ACCELERATOR [ETUDE DE LA MODULATION DE FREQUENCE DE DIVERS SIGNAUX U.H.F. EXISTANT DANS UN ACCELERATEUR LINEAIRE D'ELECTRONS]
Roland Bergere, Andre Veyssiere, and Pierre Daujat Jun. 1966 96 p refs In FRENCH
(CEA-R-2976; DRP/MNF/65-97)

A digest of a series of studies on the frequency modulation of uhf fields and signals associated with the linear electron accelerator at Saclay is presented. The frequency modulation of a uhf pulse before its injection into an accelerating structure and after its subsequent propagation when no accelerated electrons are present is considered. A similar analysis is applied to the frequency modulation due to the direct interaction of the electron beam itself and the accelerating uhf fields. The phase modulation of the elementary electron packet itself is then considered. This phase modulation can be correctly interpreted by considering the dynamics of the electron beam as such. This analysis moreover, gives a correct interpretation of the evolution of the phase modulation with time, as the elementary electron packets move along with the sinusoidal uhf accelerating fields. Author (NSA)

N67-10824# Brookhaven National Lab., Upton, N. Y. Acelerator Dept.
FORCES ON CURRENTS IN TWO-DIMENSIONAL MAGNETIC FIELDS
Richard A. Beth 23 May 1966 3 p
(Contract AT(30-2)-GEN-16)
(BNL-10324; AADD-107) CFSTI: HC $1.00/MF $0.50

A discussion is presented on the forces on currents in two-dimensional magnetic fields. NSA

N67-10825# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
FIELDS PRODUCED BY ELLIPTICAL CURRENT SHEETS
Richard A. Beth 6 Jul. 1966 9p refs
(Contract AT(30-2)-GEN-16)
(BNL-10436; AADD-112) CFSTI: HC $1.00/MF $0.50

A general solution is presented for problems dealing with elliptic cylinder current sheets. The problems are how should currents flowing along the elements of an elliptical cylinder be distributed to produce a desired magnetic field inside the cylinder and how should currents be distributed if a second outer chamber is provided to cancel the exterior field while producing a desired interior field. NSA

N67-10826# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
ELLIPTICAL CURRENT SHEETS TO PRODUCE CONSTANT-GRADIENT FIELD
Richard A. Beth 10 Jun. 1966 4 p
(Contract AT(30-2)-GEN-16)
(BNL-10341; AADD-110) CFSTI: HC $1.00/MF $0.50

A two-dimensional constant-gradient field, typical of the fields used in an alternating-gradient synchrotron is described. The distribution of currents along the elements of an elliptic cylinder to produce any required nonsingular internal field is discussed. The use of confocal elliptical current sheets to cancel external fields is also discussed. NSA

N67-10840# International Centre for Theoretical Physics, Trieste (Italy).
MATRIX ELEMENTS OF OPERATORS OF CLASS 1 REPRESENTATIONS OF SL(n,C)
C. Fronsdal and Harun Ar-Rashid Jul. 1966 18 p refs
(IC-66/89)

Let D be an irreducible representation of the group SL(n,C) by operators T_g in a Hilbert space H. A canonical basis of vectors $h \in H$ is introduced and it is shown how to evaluate the D-functions $(h_1, T_g h_2)$. It has been suggested that one such function has the physical interpretation of the electric charge form factor of the pion. This function is evaluated in detail. Author (NSA)

N67-10850# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
FIELDS PRODUCED BY CYLINDRICAL CURRENT ARRAYS
Richard A. Beth 25 Mar. 1966 8 p
(Contract AT(30-2)-GEN-16)
(BNL-10148; AADD-102)

A general current sheet theorem is formulated for treating planar fields due to cylindrical current arrays as functions of a complex variable. The theorem is illustrated for the case of an arbitrary distribution of currents flowing along the elements of a right circular cylinder. NSA

N67-10863*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE FAST FOURIER TRANSFORM IN FOURIER SPECTROSCOPY
Thomas E. Michels Jul. 1966 35 p refs
(NASA-TM-X-55613; X-622-66-316) CFSTI: HC $2.00/MF $0.50 CSCL 20F

The East Fourier Transform is presented with special application to solving the interferogram integral obtained in Fourier spectroscopy. Computational timing is tabulated and an explanation of a computer routine using this method is a binary base is presented. Author

N67-10958# Harvard Univ., Cambridge, Mass. Cruft Lab.
MAGNETIC RELAXATION IN RARE EARTH DOPED GARNET
Thomas Penney III Apr. 1966 234 p refs *Its* Ser. No. 3
(Contract AF 19(628)-3874)
(AFCRL-66-304; SR-8; AD-638910) CFSTI: HC $6.00/MF $1.25

The parallel pump instability (PPI) has been measured in Yb3+ doped YIG. The spin wave linewidth delta H sub k has a broad peak near 100K similar to the resonance linewidth peak. For 0.05% doping the PPI data in the (111) direction fits delta H sub k = 530 csch (28.6/T) + 4.3 csch (4.5+T) from 1.8K to 40K, indicating a Van Vleck-Orbach longitudinal relaxation from two doublets. The 28.6K value is the effective splitting of Yb(3+) doublets on c sites. However, the 4.5K splitting is probably associated with a small number of Yb(3+) ions on a sites. The small effect of 4.5K term is masked in resonance measurements by the constant low temperature linewidth due to two magnon scattering. In contrast, the PPI relaxation rate is independent of two magnon scattering. The 4.5K doublet may well be related to a near crossing of energy levels which probably causes the anomalous low temperature peaks in delta H and resonance field observed by Dillon Author (TAB)

N67-10969# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

CONDUCTIVITY CHANGES PRODUCED IN ICE BY OPTICAL IRRADIATION 0.8 TO 2.7 μ

P. R. Camp and D. L. Spears Aug. 1966 33 p refs
(CRREL-RR-175; AD-638923) CFSTI: HC $2.00/MF $0.50

A series of experiments attempt to produce orientational defects and ions by optical injection. The basic experiment was one on transient photo-conduction produced by an intense light pulse. The effects of intensity and wavelength of the incident light, temperature of the sample and area of illumination of the sample were studied. It was concluded that neither orientational defects nor ion pairs were produced in appreciable quantity by the light but that the apparent photo-conduction observed was the result of flash-heating of a thin surface region which had significantly different properties than had the bulk of the sample. Simple and somewhat speculative assumptions regarding the photo-generation process lead to the conclusion that the photo-efficiency, at least for ion pair production, must be very low. Author (TAB)

N67-10970# Rand Corp., Santa Monica, Calif.

ESTIMATION OF LOCAL ANISOTROPIC SCATTERING PROPERTIES USING MEASUREMENTS OF MULTIPLY SCATTERED RADIATION

H. H. Kagiwada and R. E. Kalaba Sep. 1966 33 p refs
(Contract AF 49(638)-1700; Proj. Rand)
(RM-5075-PR; AD-638905) CFSTI: HC $2.00/MF $0.50

The local anisotropic scattering property is estimated on the basis of knowledge of multiple-scattering properties. The phase function is expanded in a series of legendre polynomials, and the coefficients are determined so as to best explain diffuse reflection measurements. The computational scheme is described and results are given. The Fortran program is presented in the appendix. Author (TAB)

N67-10982# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.

FURTHER MEASUREMENTS OF THE NEAR IR SPECTRUM OF SHOCK-HEATED AIR

Walter H. Wurster and Paul V. Marrone Aug. 1966 44 p refs
(Contract Nonr-3960(00); ARPA Order 322; Proj. Defender)
(CAL-QM-1756-A-1; AD-638781) CFSTI: HC $2.00/MF $0.50

Quantitative spectroscopic measurements were made of the infrared spectrum of shock-heated air and nitrogen between 0.9 and 1.3 micron. The measurements for air were obtained in the reflected shock region of a shock tube, covering the temperature range 6500-7200K. The nitrogen data were obtained behind incident shock waves for temperatures between 4600-5700K, and in the reflected shock region for temperatures from 6800-7500K. In a previous study it was shown that air radiates much more significantly than nitrogen in this spectral range, and that the radiation could be attributed to transitions between excited electronic states of the nitric oxide molecule. The present measurements confirm these results and also show that the observed excitation energy of the radiation is inconsistent with the energy levels in nitrogen. The data from both studies are reviewed, and it is concluded that the NO hypothesis is consistent with the experimental evidence Author (TAB)

N67-10999# North Carolina State Coll., Raleigh.

TEMPERATURE DEPENDENCE OF THE ABSORPTANCE OF AMMONIA NEAR 850 CM^{-1}

Alexander K. Rooers, Edward R. Manring, and Richard R. Patty May 1966 47 p refs
(Contract AF 19(628)-3898)
(AFCRL-66-458; SR-2; AD-638747) CFSTI: HC $2.00/MF $0.50

The equipment and experimental techniques used to observe the temperature dependence of absorptance in a small region of the 950/cm band of ammonia are described. The integrated absorptance of two spectral lines was measured at 214K and 300K for samples of pure ammonia and samples of ammonia broadened with nitrogen. The results are presented as plots of total absorptance for the small spectral region versus absorber concentration u and total pressure P. An equivalent pressure Pe is expressed in terms of a self-broadening coefficient B which is function of the ratio of the optical collision diameters. Self-broadening coefficients are determined at 214K and 300K. Integrated absorptances at 300K are compared with those obtained for samples at 214K to determine whether the temperature dependence is that predicted by the Lorentz theory Author (TAB)

N67-11041# RAND Corp., Santa Monica, Calif.

THE DEVELOPMENT OF A RADIO SIGNAL FROM A NUCLEAR EXPLOSION IN THE ATMOSPHERE

Victor Gilinsky Aug. 1966 25 p refs
(RM-4988; AD-639600) CFSTI: HC $1.00/MF $0.50

The dipole radio signal from a low altitude atmospheric nuclear explosion of low yield is computed by numerically integrating Maxwell's equations. The source is described by a simple model. The function describing the time history of the rate of gamma output is taken to be an isosceles triangle with a base equal to a fraction of a microsecond. The asymmetry necessary for radiation comes entirely from the variation of air density with altitude. The dipole fields are shown as functions of position for various times after the explosion. These curves form, in effect, a motion picture of the development of the signal Author (TAB)

N67-11100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

A PROBLEM OF OPTIMUM MOTION OF BALLISTIC ROCKETS

A. S. Galiullin 25 Apr. 1966 8 p refs Transl. into ENGLISH from Tr. Mosk. Univ. Druzhby Narodov. (Moscow), v. 1, 1963 p 68–70
(FTD-TT-65-1917; TT-66-62316; AD-639336) CFSTI: HC $1.00/MF $0.60

Translation of Russian research: a problem of optimum motion of ballistic rockets. TAB

N67-11178# Naval Radiological Defense Lab., San Francisco, Calif.

COMPARISON OF THE STEADY STATE OPERATOR OF PRIGOGINE WITH THE T-MATRIX

William C. Schieve 16 Aug. 1966 48 p refs
(USNRDL-TR-1057; AD-638889) CSFTI: HC $2.00/MF $0.50

Using their general perturbation methods for solving the Liouville equation, the Prigogine group has derived a transport operator, i psi (+io). By means of this operator a generalized transport equation governing the dynamic aspects of transport

phenomena may be formed. It is the purpose here to compare the results of this with those obtained by means of a generalized gain-loss equation formed with the T-matrix. The latter is governed by the Lippman-Schwinger equation of scattering theory. This gain-loss equation has been used heuristically in practical calculations of transport coefficients. It is of particular interest to compare the two methods in the lambda 4th order of perturbation theory where Prigogine's irreducibility condition enters seriously for the first time. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N67-10028# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.

A FIELD THEORY OF ELEMENTARY PARTICLES WITH S_3 INVARIANCE

Yasuhisa Katayama Aug. 1966 17 p refs
(RIFP-54) CFSTI: HC $1.00/MF $0.50

A field theory of elementary particles is presented and examined with the following assumptions: (1) There are three basic fermion fields. (2) Three fields are described by nonlinear equations with symmetry of their permutation. (3) They obey a regularized quantization with a single constant. The 0-nonet mesons and 1/2-octet baryons are assumed as the composite systems of three basic fields. Their mass eigenvalues and the effective coupling constants are calculated. Author

N67-10039# Portugal. Nuclear Energy Commission. Sacavem. Nuclear Reactor Div.

MEASUREMENT OF RESONANCE ABSORPTION INTEGRALS (Mn, Fe, Co, Ni, Cu, Zr, Mo) [MESURE DES INTEGRALES DE RESONANCE D'ABSORPTION (Mn, Fe, Co, Ni, Cu, Zr, Mo)]

Rene Vidal and E. Cardoso Martinho 1965 43 p refs In FRENCH
(LFEN-45(8)) CFSTI: HC $2.00/MF $0.50

A general definition for resonance integral is presented, and the total resonance integral is deducted from a mathematical model. An analysis of calculations made showed good agreement between experimental and theoretical results for manganese, iron, cobalt, nickel, copper, zirconium, and molybdenum. The sensitivity and accurate measurements of the MINERVE reactor are mentioned. Transl. by R.LI.

N67-10058# Polish Academy of Sciences, Cracow. Inst. of Nuclear Phys.

ON THE MAGNETIC PROPERTIES OF THE ^{171}Tm NUCLEUS

Zbigniew Bochnacki and Stanislaw Ogaza Jun. 1966 13 p refs Submitted for Publication
(Rept.-482/PL) CFSTI: HC $1.00/MF $0.50

The available experimental data on the magnetic properties of the ground state K = 1/2 rotational band of the Tm^{171} nucleus are analyzed in terms of the effective spin g-factors. It is shown that these data can be explained by taking into account a spin polarization of the even core by the odd proton, if the transverse spin polarization is different from the longitudinal one. Author

N67-10137# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

THE PROBLEM OF DYNAMICAL GROUPS IN QUANTUM MECHANICS

A. Szymacha and J. Werle Feb. 1966 13 p refs
(INR-687/VII/PH) CFSTI: HC $1.00/MF $0.50

The restrictions imposed by the existence of a dynamical group of the Hamiltonia $H = 1/2p^2 + V(r)$ are investigated. It is shown that the potentials $V = -c/r$ or $V = ar^2$ necessarily follow from the respective dynamical groups O_4 or SU_3 without the use of the additional assumptions made by other authors. Author

N67-10198*# National Aeronautics and Space Administration, Washington, D. C.

QUANTUM MECHANICAL CALCULATION OF CHARGE EXCHANGE PROBABILITY DURING COLLISIONS [KVANTOVO-MEKHANICHESKIY RASCHET VEROYATNOSTI PEREZARYADKI PRI STOLKNOVENIYAKH]

Yu. N. Demkov Sep. 1962 39 p refs Transl. into ENGLISH from Uch. Zap. Leningr. Gos. Univ. Ser. Fiz. Nauk (Leningrad), v. 8, no. 146, 1952 p 74–100
(NASA-TT-F-9707) CFSTI: HC $2.00/MF $0.50 CSCL 20H

In an examination of a charge exchange, the parametric method and the Born approximation are outlined. Specifically, the case of a resonance charge exchange calculated by the parametric method is reviewed. Mathematical solutions are given for the adiabatic method of calculation. The complete cross section of a resonance charge exchange in the cases of hydrogen and helium is calculated, with the presumption that nuclei are in essence classical particles. An approximate expression for the cross section of a resonance charge exchange in a general case is also obtained. The applicability of the method was evaluated, and a determination made as to how accurate a resonance level should be in order for the effective cross section to reach values which are common for a resonance charge exchange. Experimental results obtained were considered satisfactory and applicable for the velocities of ions which are present in a plasma of a gas discharge. R.LI.

N67-10239*# Western Reserve Univ., Cleveland, Ohio.

THE INTERNAL COMPTON EFFECT

M. P. Bedesem and K. J. Casper Washington, NASA, Nov. 1966 63 p refs
(Grant NsG-655)
(NASA-CR-633) CFSTI: HC $2.50/MF $0.75 CSCL 20H

Investigations are presented to confirm the existence of the internal Compton effect and to determine whether the distributions could be used to determine the polarity of nuclear transitions. Various theoretical calculations for the internal Compton effect are applied to the observed data. The purpose of comparing the theoretical predictions with the observed data is to identify the distributions below the conversion lines as resulting from the internal Compton effect. A new method for determining the multipolarity assignments by observing the internal Compton effect with the superconducting magnet spectrometer is described. The superconducting magnet spectrometer, when operated in conjunction with silicon solid state detectors, provides a means of analyzing electron spectra under conditions of minimum distortion from gamma and backscattering distributions. S.P.

N67-10272# Illinois Univ., Urbana. Dept. of Physics.

FADDEEV EQUATIONS FOR THE $K \rightarrow 3\pi$ AMPLITUDE

I. M. Barbour and R. L. Schult [1966] 52 p refs
(Contract Nonr-1834(05))
(AD-637252) CFSTI: HC $3.00/MF $0.50

Integral equations for the three pion decay amplitude of the K-meson are derived in the context of a potential scattering model. Non local S- and P-wave separable potentials are used. Some numerical solutions are presented. The shapes of the decay spectra are found to be independent of the potential. The connection with the integral equations of Khuri and Treiman is discussed. A zero range approximation requires that A exp 2 sub 2 > A exp 2 sub 0 data. Some aspects of three body states in

the presence of a resonance are investigated. No observable effects of a triangle singularity are found for the cases considered Author (TAB)

N67-10369# Illinois Univ., Urbana. Dept. of Physics.
NUCLEAR PHYSICS Final Report
30 Aug. 1966 60 p refs
(Contract Nonr-1834(05))
(AD-638349) CFSTI: HC $3.00/MF $0.75

The report consists primarily of a listing of the faculty and graduate students involved in the research, and of the Ph.D. theses, published journal articles, and technical reports which contain substantial information which was not otherwise published. These results of research are presented in this report by projects or areas in the following sections: Cyclotron Research Program; Frauenfelder Group Program in Low-Energy Physics; Theoretical Nuclear Physics; The Betatron Laboratory Program; High-Energy Events in Nuclear Emulsions; Nuclear Magnetic Resonance; Nuclear Effects at Low Temperatures; Atomic Physics Experiments. TAB

N67-10441# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
PHOTONUCLEAR DATA INDEX
1 Apr. 1966 96 p refs *Its* Misc. Publ.-277 GPO: $0.55

An index to experimental data on photonuclear reactions is presented. Organized by element and isotope, each entry in the index supplies quantitative information for a specific reaction on the ranges of excitation energy, source energy, detected particle energy, and emission angles for reaction produced covered in each reference. Information is also given on the type of measurement and detector used. Author

N67-10451# National Bureau of Standards, Boulder, Colo. Radio Standards Lab.
SOME PROPERTIES OF THE EIGENFUNCTIONS AND EIGENVALUES INTRODUCED BY BETHE FOR THE LINEAR CHAIN OF ATOMS
Henry Unruh, Jr. 19 Apr. 1966 21 p refs
(NBS-TN-328) GPO: $0.25

The operations $S^2\psi$ and $S^z\psi$ in which ψ is an exact eigenfunction obtained by Bethe for the linear chain of localized spins, are discussed. The operations S^2 and S^z are the usual square of the total angular momentum and the raising and lowering operators respectively. The results, valid for an arbitrary number of spin inversions, show, as expected, that all possible states of the system can be achieved by omitting all excitations associated with zero wave number but requiring each state to take all possible orientations in space. Author

N67-10488# RAND Corp., Santa Monica, Calif.
THE CALCULATION OF SOBOLEV'S ϕ FUNCTION OF RADIATIVE TRANSFER VIA NUMERICAL INVERSION OF LAPLACE TRANSFORMS
H. Kagiwada and R. Kalaba Aug. 1966 18 p refs
(Contract AF 49(638)-1700; Proj. Rand)
(RM-5121-PR; AD-638396) CFSTI: HC $1.00/MF $0.50

The linear integral equation of convolution type for Sobolev's function phi is solved computationally using a new method for the numerical inversion of Laplace transforms Author (TAB)

N67-10528# Oak Ridge National Lab., Tenn.
PHOEBE—A CODE FOR CALCULATING BETA AND GAMMA ACTIVITY AND SPECTRA FOR ^{235}U FISSION PRODUCTS
E. D. Arnold Jul. 1966 64 p refs
(Contract W-7405-ENG-26)
(ORNL-3931) CFSTI: HC $3.00/MF $0.75

A computer code, PHOEBE, is presented for calculating the decay properties of mixed fissions products resulting from the fission of ^{235}U. Fission product beta and gamma activity and spectra are calculated for these fission products as a function of power, irradiation time, and decay time. Either constant or variable power may be specified for the reactor operation period. The code contains a permanent data section that describes the release rates as a function of time since fission. A discussion of these data functions; that is, how they were obtained, how they are used, and how they may be modified is included. NSA

N67-10530# Los Alamos Scientific Lab., N. Mex.
THE SILVER COUNTER. A DETECTOR FOR BURSTS OF NEUTRONS
Robert J. Lanter and Daniel E. Bannerman 14 Jul. 1966 36 p refs
(Contract W-7405-ENG-36)
(LA-3498-MS) CFSTI: HC $2.00/MF $0.50

The silver counter uses a detector consisting of G-M tubes and silver foils in a polyethylene moderator. It measures the beta decay of silver activated by neutrons. The count obtained in a 1-min interval immediately following the burst of neutrons indicates the number of neutrons. Graphs of calibration factors as functions of source-to-counter distances are given. The sensitivity to 14-MeV neutrons is one count per 5000 neutrons from a source 12.8 cm from the detector. For 2.4-MeV neutrons, the sensitivity is one count per 2200 neutrons at 12.8 cm. The background rate is approximately 200 cpm. Author (NSA)

N67-10533# Argonne National Lab., Ill.
ARGONNE CYCLOTRON—HELIUM-3 CONVERSION
W. J. Ramler, R. Benaroya, G. W. Parker, and J. Aron Feb. 1966 29 p refs
(Contract W-31-109-ENG-38)
(ANL-7171) CFSTI: HC $2.00/MF $0.50

The Argonne 60-inch cyclotron has been operating since 1952 with projectiles limited to a charge-to-mass (Q/M) ratio of 1/2, i.e., D^+, H_2^+, $^4He^{2+}$, and $^6Li^{3+}$. The cyclotron was modified to permit acceleration of $^3He^{2+}$ ions. Required modifications were accomplished in the period from May to August, 1964. These modifications, along with the ^3He gas-recovery system and resulting accelerator operation, are discussed. Author (NSA)

N67-10541# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
IONIZATION POTENTIALS OF ATOMS AND IONS FROM H TO Ni (Z=28) [IONISIERUNGSENERGIEN VON ATOMEN UND IONEN DER ELEMENTE H BIS Ni (Z=28)]
Wolfgang Lotz Jul. 1966 29 p refs In GERMAN; ENGLISH summary
(IPP-1/49) CFSTI: HC $2.00/MF $0.50

A complete set of ionization potentials of all ionization stages is given for the elements hydrogen through nickel (Z=28). the ionization potentials are calculated along isoelectronic sequences with full regard to experimental values. Along experimentally well established sequences the difference to the next higher species is calculated by extrapolation of the differences of the differences (second difference or second derivative) and the third difference (derivative). Experimentally not so well established sequences are calculated by extrapolation of the difference to the same ionization stage of one of the better known sequences. Similarities in the periodic table are taken into account. Author

N67-10547# Nihon Univ., Tokyo (Japan). Dept. of Physics.
TRANSFORMATION PROPERTIES OF THE RIGID SPHERE FUNCTIONS AND THEIR RELATION TO THE DIRAC SPINOR
Osamu Hara, S. Y. Tsai, and Haruichi Yabuki [1966] 22 p refs
(NUP-66-13) CFSTI: HC $1.00/MF $0.50

It is shown that the wave functions of a rigid sphere belonging to the eigenvalue J=1/2, where J denotes the magnitude of the angular momentum due to the rotation of the sphere around its center of mass, transform in exactly the same way as the Dirac

spinor under the spatial rotation, space inversion and the Lorentz transformation, and that the Dirac equation is derived automatically from the properties of these wave functions. Author

N67-10553# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
THE INFRARED RADIATIVE CORRECTIONS FOR COLLIDING BEAM (ELECTRONS AND POSITRONS) EXPERIMENTS
Etim-Etim, G. Pancheri, and B. Touschek 22 Aug. 1966 27 p refs /ts Nota Interna No. 331
(LNF-66/38) CFSTI: HC $2.00/MF $0.50

Methods for applying radiative corrections to measured results in searches for a possible breakdown of quantum electrodynamics are presented. The considerations are confined to high energy reactions of the type $e^+ + e^- \rightleftharpoons A + \bar{A}$, where $\bar{A}$ is the antiparticle of A and it is assumed that $m_A \cdot 0$. The results are applicable to experiments in which the momentum resolution is sufficient to guarantee that the energy lost in the form of radiation is small compared to the center of mass energy lost in the form of radiation is small compared to the center of the mass energy of the electron. C.T.C.

N67-10564# Oxford Univ. (England). Nuclear Physics Lab.
DESTRUCTIVE INTERFERENCE OF HOLE AND COLLECTIVE E2-TRANSITION AMPLITUDES
H. J. Rose, J. S. Lopes, and W. Greiner Sacavem, Portugal, Nucl. Energy Comm., 1965 10 p refs
(LFEN.47(-5)) CFSTI: HC $1.00/MF $0.50

Based on the assumption that destructive interference (between the single hole and the collective contribution to the E2-matrix element) was caused by an opposite sign of the expansion coefficients of the $|3/2^-\rangle$ eigenfunction, which implies that the reduced matrix elements originating from the single hole and the collective contributions were of the same sign, an interpretation of the experimental results in terms of deformed eigenstates in ^{16}O was undertaken. The E2 multipole operator for emission of a L=2 quantum originating from a single proton transition is defined, and its hermitian adjoint given. To describe the $3/2^-$ excited 6 MeV states and the $1/2^-$ ground states of ^{15}N and ^{15}O in terms of single holes in the ^{16}O nucleus, consideration is given to the deformed lowest rotational states of the ^{16}O closed core. It is seen that destructive interference between the collective and single hole E2-amplitudes will occur if the unperturbed single hole state is located in energy above the unperturbed collective state of the core. This effect is independent of whether the core is oblate or prolate and of whether the deformed contribution to the ^{16}O ground state adds with positive or negative phase. R.LI.

N67-10569# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
TRANSVERSE SUM RULE FOR ELECTRONS SCATTERED INELASTICALLY WITH LARGE MOMENTUM TRANSFERS FROM LIGHT NUCLEI
Wieslaw Czyz, Leonard Lesniak, and Andrzej Malecki May 1966 49 p refs Submitted for Publication
(Rept.-479/PL) CFSTI: HC $2.00/MF $0.50

A sum rule for the cross sections of electrons inelastically scattered from nuclei is analyzed. This sum rule contains contributions only from the transverse electron-nucleus interactions and is particularly suitable for analyzing to experiments of inelastic electron scattering at $\theta = 180°$. The sum rule is a function of the three momentum transfer q. A discussion of this sum rule for momentum transfers $0.5\ f^{-1} \leq q \leq 2\ f^{-1}$ is presented. Strong dominance of the spin-current contribution seems to offer a very attractive possibility of measuring magnetic moments of nucleons bound in nuclei. The paper contains estimates of the short range nucleon-nucleon correlation contributions to the sum rule. Author

N67-10608# California Univ., Livermore. Lawrence Radiation Lab.
THE (n,2N) REACTION INDUCED BY 14.5-MeV NEUTRONS
Donald G. Gardner 10 Mar. 1966 21 p refs Presented at the Am. Phys. Soc. Conf. on Neutron Cross Sect. Technol., Washington, D. C., 22–24 Mar. 1966
(Contract W-7405-ENG-48)
(UCRL-14575; CONF-660303-46) CFSTI: HC $1.00/MF $0.50

With a statistical-model approach the ratios of the cross sections for the (n,2n) reaction on adjacent isotopes of all elements in the range 30 $Z \leq 83$ have been computed as a function of energy. These ratios have been semiempirically normalized at 14.5 MeV to obtain predictions of absolute (n,2n) cross sections. This approach is compared with other methods for computing (n,2n) cross sections, and (n,2n) cross sections to evaluate the importance of pairing effects is illustrated. Also, a few excitation functions are computed and compared with experimental data. Author (NSA)

N67-10609# California Univ., Berkeley. Lawrence Radiation Lab.
REGENERATIVE BEAM EXTRACTION
Hogil Kim Apr. 1966 11 p refs Presented at the Intern. Conf. on Isochronous Cyclotrons, Gatlinburg, Tenn., 1–5 May 1966
(Contract W-7405-ENG-48)
(UCRL-16793; CONF-660510-14) CFSTI: HC $1.00/MF $0.50

A review of regenerative beam extraction for synchrocyclotrons and isochronous cyclotrons is presented. The linear and nonlinear theories of the system for synchrocyclotrons are briefly reviewed. the problems for the extraction efficiency and external beam quality are discussed. A theory for isochronous cyclotrons is given. Finally, present operating features of the systems and future prospects are summarized. Author (NSA)

N67-10610 Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
REPORT OF ACTIVITY, OCTOBER 15, 1965–APRIL 15, 1966 [RAPPORT D'ACTIVITE, 15 OCTOBRE 1965–15 AVRIL 1966]
Jun. 1966 62 p refs In FRENCH
(LAL-1159)

The improvement and utilization of the accelerator are summarized, together with research progress in nuclear physics, nuclear spectroscopy, pion physics, and storage rings. Development of associated experimental equipment and radiation control are reported. A bibliography of the publications during this period is appended. NSA

N67-10613# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON ELECTROMAGNETIC FORM FACTORS OF NUCLEONS AND MINIMAL INTERACTION OF QUARKS [K VOPROSU OB ELEKTROMAGNITNYKH FORMFAKTORAKH NUKLONOV I MINIMAL'NOM VZAIMODEISTVII KVARKOV]
V. A. Matveev and V. P. Shelest 20 May 1966 6 p refs In RUSSIAN
(JINR-P-2757)

A correct relation between electric and magnetic form factors of nucleons in the model of complex particles is obtained on the basis of the minimal quark interaction. Author (NSA)

N67-10614# International Centre for Theoretical Physics, Trieste (Italy).
QUARK MODEL DERIVATION OF MESON-BARYON COUPLING CONSTANT RELATIONS
R. J. Rivers 4 Jul. 1966 9 p refs Submitted for publication
(IC-66/80)

Using a simple quark model for baryon-meson vertices, coupling constant relations are derived such that under certain circumstances are the same as those derived from current algebra. Author (NSA)

N67-10615# International Centre for Theoretical Physics, Trieste (Italy).
QUARK MODEL AND ELASTIC BARYON–BARYON SCATTERING
D. A. Akyeampong Jun. 1966 8 p refs Submitted for Publication Supported in Part by Ghana Univ.
(IC-66/76)

The consequences of the quark model proposed recently by Lipkin and Scheck are investigated for baryon–baryon and baryon–antibaryon scattering. It is found that, apart from the unpleasant prediction $\sigma^{tot}(\bar{p}p) > \sigma^{tot}(\bar{p}n)$, all other predictions are in reasonable agreement with experiment. Author (NSA)

N67-10616# Brookhaven National Lab., Upton, N. Y.
MEASUREMENT OF MEGARAD DOSES OF ^{60}Co GAMMA RAYS WITH ULTRAVIOLET TRANSMITTING LUCITE
A. C. Muller, F. X. Rizzo, and R. B. Mogk Mar. 1966 9 p ref
(Contract AT(30-2)-GEN-16)
(BNL-985) CFSTI: HC $1.00/MF $0.50

Commercially manufactured ultraviolet transmitting Lucite was evaluated as an integrating gamma dosimeter. Cobalt-60 gamma irradiation induces an ultraviolet absorbance in Lucite and this absorbance is directly proportional to absorbed dose in the range from 10^4 to 6×10^6 rads. After the proper corrections are made for bleaching and thickness, dosimetric measurements can be made with an expected precision of ±3%. Author (NSA)

N67-10617# Joint Inst. for Nuclear Research, Dubna (USSR.) Lab. of Nuclear Problems.
MEASUREMENT OF THE ENERGY OF (2P-1S) TRANSITIONS IN MUONIC ATOMS OF ELEMENTS FROM SULFUR TO CHROMIUM [IZMERENIE ENERGII (2P-1S)-PEREKHODOV MYUONOV V ATOMAKH OT SERY DO KHROMA]
Yu. G. Budyashov, V. G. Zinov, A. D. Konin, and A. I. Mukhin 7 May 1966 11 p refs In RUSSIAN
(JINR-P-2735)

The energies of /2P-1S/ transitions in muonic atoms of S, Cl, Ar, K, Ca, Cr are measured with an accuracy of 0.3% using a NaI spectrometer. The obtained results agree well with the theoretical calculations. Author (NSA)

N67-10618# Joint Inst. for Nuclear Research, Dubna (USSR.) Lab. of Theoretical Physics.
SYMMETRY BREAKING QUASI-PARTICLE METHOD FOR BARYONS AND FOR QUARKS. II BOUND STATE PROBLEM
K. S. Vol'rab 6 Apr. 1966 24 p refs Submitted for Publication
(JINR-E-2714)

The quasiparticle method is applied to a SU_3 symmetric four-fermion interaction between octet baryons N and antibaryons $\bar{N}$ (or between quarks and antiquarks). The physical particles and resonances themselves appear as quasiparticles. The form of the individual quasiparticle operators is $\Omega = uN + v\bar{N}^*$. Applications are made to the baryon spectra. Spontaneous dynamical symmetry-breaking of SU_3 appears and leads to a Gell-Man–Okubo formula in the strong coupling limits (similar results for quarks). Higher-order quasiparticles, especially the octet-meson spectra, are studied in the roughest approximation. Author (NSA)

N67-10619# International Centre for Theoretical Physics, Trieste (Italy).
TESTS OF MODELS OF ELEMENTARY PARTICLES
Susumu Okubo Jun. 1966 37 p refs Submitted for Publication
(IC-66/65)

By means of the algebra of currents, the validity of models of elementary particles were tested. From studies of the decay rate of $\pi_0 \rightarrow 2\gamma$, a calculation of the axial vector renormalization constant g_A, the decay rates of $V_8 \rightarrow 1+\bar{1}$ and those of $V_8 \rightarrow P_8+\gamma$ decays, it was concluded that the fractionally charged quark model of Gell-Mann and Zweig is the best candidate among all others. Author (NSA)

N67-10622# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
TRIPLETS, STATIC SU(6), AND SPONTANEOUSLY BROKEN CHIRAL SU(3) SYMMETRY
Y. Nambu Jan. 1966 10 p refs Revised
(Contract AT(11-1)-264)
(COO-264-308; CONF-650947-4; EFINS-66-19) CFSTI: HC $1.00/MF $0.50

Current problems in elementary particle theory are examined in relation to recent successes of SU(3) and SU(6) symmetries. NSA

N67-10624# International Centre for Theoretical Physics, Trieste (Italy).
MULTIPLE FIELD RELATIONS
R. Delbourgo (Imperial Coll. of Sci. and Technol.), Abdus Salam, and J. Strathdee 12 Jul. 1966 10 p refs Submitted for publication
(IC-66/85)

A common basis for three elements of particle theory: higher symmetry multiplets, a postulated algebra for weak currents, and PCAC and similar hypotheses, is suggested. The basis is established by postulating (with Heisenberg) that there exists fundamental fields and all matter is made up from them. NSA

N67-10627# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
MEASUREMENT OF ELECTROMAGNETIC CASCADES AND THEIR PRODUCTION OF NEUTRONS AT 6.3 GeV [MESSUNG ELEKTROMAGNETISCHER KASKADEN UND DER VON IHNEN ERZEUGTEN NEUTRONEN BEI 6.3 GeV]
G. Bathow, E. Freytag, and K. Tesch May 1966 42 p refs In GERMAN; ENGLISH summary
(DESY-66/13)

The electromagnetic cascades produced by 6.3-BeV Bremsstrahlung in lead, copper, and heavy concrete were measured by means of an ionization chamber. The measured transition curves are compared with existing Monte Carlo calculations. Data useful for shielding calculations are given. Neutrons produced by the cascades are measured by activation foils in several energy ranges, the results are compared with estimates. The angular distributions of the neutrons and in some cases their attnuation by the material are presented. Author (NSA)

N67-10633# Maryland Univ., College Park. Dept. of Physics and Astronomy.
MEASUREMENT PROCESSING FOR CHARGED Σ PRODUCTION REACTIONS NEAR 1 BeV/c
Gordon R. Charlton Apr. 1966 51 p ref
(Contract AT(40-1)-2504)
(TR-559; ORO-2504-90) CFSTI: HC $3.00/MF $0.50

A computing technique for analyzing the data from meson (K^-) decays is described in detail. The code analyzes the production of $\Sigma^\pm$ in two- and three-body decays. NSA

N67-10636# International Centre for Theoretical Physics, Trieste (Italy).
CALCULATION OF THE FORM FACTORS IN K_{l3} DECAY
A. Bartl and C. P. Korthals Altes Jun. 1966 11 p refs Submitted for Publication
(IC-66/74)

An evaluation of the form factors of the K_{l3} decay is performed by means of the SU(3) algebra of currents and the method of Fubini et al. The SU(3)-breaking corrections are calculated with help of dispersion technique, taking into account the lowest lying intermediate states. Author (NSA)

N67-10637# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

CAN CURRENT OPERATORS DETERMINE A COMPLETE THEORY?

J. Langerholc and B. Schroer May 1966 22 p refs
(DESY-66/14)

For the free field currents $j_\mu(x)$ in the sector of charge zero we prove that one can reconstruct the bilocal fields $\bar{\psi}(x)\,\psi(y)$. Author (NSA)

N67-10639# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

BREMSSTRAHLUNG OF ELECTRONS WITH E=2.4 GeV [TORMOZNOE IZLUCHENIE ELEKTRONOV S E=2.4 GeV]

Ya. Bem, V. G. Grishin, and V. D. Ryabtsov 1966 12 p refs In RUSSIAN
(JINR-P-2744)

Bremsstrahlung of the electrons with E=2.4 BeV was investigated with a 24-liter propane chamber. 179 events of electron–proton interaction were found, when the bremsstrahlung γ-quantum has $E_\gamma \geq 0.75$ E. Experimental data agree with the theoretical calculations. Author (NSA)

N67-10641# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

MASS FORMULAS FOR PARTICLE WITH SPIN OF 1 AND 3/2 IN SU(3) BROKEN SYMMETRY [MASSOVYE FORMULY DLYA CHASTITS SO SPINOM II 3/2 V NARUSHENNOI SU(3) SIMMETRII]

A. T. Vainshtein 1965 12 p refs In RUSSIAN; ENGLISH summary
(Rept.-398)

Mass relations linear in masses in the case of $3/2^+$ baryons and quadratic for vector mesons are derived using the coverant approach to the study of broken SU(3) symmetry based on the equal time commutators and dispersion relations. Author (NSA)

N67-10644# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

CALCULATION OF ELECTRON ACCELERATION UP TO 30 MEV BY RECTANGULAR RESONATORS IN MICROTRON [RASCHET USKORENIYA ELEKTRONOV DO 30 MEV PRYAMOUGOL'NYMI REZONATORAMI V MIKROTRONE]

I. M. Matora, L. A. Merkulov, and I. I. Shelontsev 1966 31 p refs In RUSSIAN Submitted for Publication
(JINR-P-2706)

Results are presented of numerical calculations of electron acceleration up to 30 Mev in the microtron at the JINR. The phass stability region for the so-called second mode of acceleration is specified as well as the distribution of phase losses of the beam along the orbits. The influence of the microwave magnetic field on the beam parameters extracted from the microtron is cleared up. The rectangular resonator with a square cross-section chosen according to calculations allowed to obtain pulsed currents of the extracted beam to be 60 ma at the electron energy of 30 Mev. Author (NSA)

N67-10646# Franklin GNO Corp., West Palm Beach, Fla.

COMPARATIVE MERITS OF RADIOISOTOPE AND MACHINE SOURCES OF X-RADIATION FOR AEROSPACE APPLICATIONS

30 Mar. 1966 87 p refs
(Contract AT(40-1)-3408)
(ORO-647) CFSTI: HC $3.00/MF $0.75

Results of a study performed to define the relative advantages and limitations of radioisotope and machine sources of radiation for typical aerospace applications are presented. The advantages and limitations of representative state-of-art gamma and x-radiation sources were examined with regard to the aerospace application potential. The areas of unique difference between radioisotope and machine sources are isolated and described in order to delineate clearly the area of aerospace application particularly suitable to each of these radiation sources. Author (NSA)

N67-10647# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.

THE CONFIGURATION OF SPLITTING OF THE DIPOLE GIANT RESONANCE FOR THE NON-MAGIC NUCLEI OF 1d-2s SHELL AS DEMONSTRATED BY S^{32}

B. I. Goryachev, (Moscow State Univ.), L. Majling, V. G. Neudatchin, and B. A. Yuryev Jul. 1966 15 p refs
(UJV-1612)

It was shown by specific calculations for ^{32}S that the configurational splitting of the giant resonance is conserved even after the residual interaction was taken into account. The results for two cases are compared: ^{32}S as a closed sub-shell $1d_{5/2}+2S_{1/2}$ and as a soft core distorted in particular, under the influence of the quadrupole vibrations. The most general features of the dipole absorption curve are comparatively stable with respect to the perturbation of the wave function of the ground state and at the same time the details of this curve are substantially different. The results of the calculations reproduce correctly the characteristic features of the absorption curve, in particular, a very considerable width of the absorption region. The fact that only the left part of the absorption curve is excited in the reaction (p,γ_0) and the elastic scattering cross section has two maxima finds good explanation. Author (NSA)

N67-10648# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.

DIFFERENTIATION BETWEEN Er I AND Er II SPECTRA USING ONLY A DC ARC AS EXCITATION SOURCE

Sima Held Jan. 1966 164 p refs Sponsored by Natl. Bur. of Std.
(IA-1037)

Differentiation between the neutral atom and ion spectra of Er in the 2260–6900A spectral range was achieved using only a d-c arc as excitation source. The wavelengths were taken from Gatterer and Junkes in the spectral range 2262.50–2670.26 Å and from Marquet in the spectral range 2670.26–6897.43 Å. In the present work, in addition to the 1500 lines already classified as ErI or ErII, about 3000 lines from the Marquet list of Er lines are assigned to the first or second spectrum. The spectrum assignments given in the present work for lines already classified are compared with the published data. Discrepancies were observed for about 60 lines. About 700 ErI lines in the spectral region above 3600 Å are assumed to originate from high energy discharge. It was found that about 300 of the lines included in Marquet's list of Er lines probably do not belong to erbium but to the impurities Zr, Ti, Tm and Fe. Approximately half the lines listed by Marquet were not detected on the spectrograms obtained under the experimental conditions of the present work. Author (NSA)

N67-10652# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

EFFECT OF CO^{60} γ RADIATION AND OF THERMAL NEUTRONS ON HIGH-RESISTIVITY P AND N SILICON. POSSIBILITY OF OBTAINING A NUCLEAR COMPENSATION FOR P-TYPE SILICON [EFFETS DU RAYONNEMENT γ DU COBALT 60 ET DE NEUTRONS THERMIQUES SUR DU SILICIUM P ET N DE HAUTE RESISTIVITE. POSSIBILITE DE REALISER UNE COMPENSATION NUCLEAIRE D'UN SILICIUM DE TYPE P]

Jean Messier (Ph.D. Thesis—Paris Univ.) 1965 102 p refs In FRENCH
(CEA-R-2918)

Type p silicon was compensated by the production of a controlled and uniform amount of donor atoms (^{31}P) using thermal neutrons to bring about a nuclear transformation. It is shown that

it is possible in this way to reduce by a factor of about one hundred the overall concentration of residual ionized impurities in the purest crystals obtained by floating zone purification (2×10^{12} atoms/cm^3). The degree compensation obtained is limited by the initial inhomogeneity of acceptor impurities which have to be compensated. Lattice defects which still remain after prolonged annealings reduce the lifetime of the material to about 10 μs approximately. Particle detectors having thicknesses of 2 to 5 mm were built by this process; they give good results, particularly at low temperatures. Author (NSA)

N67-10654# Atomic Energy Information Service, Frankfurt am Main (West Germany).
BIBLIOGRAPHIES IN NUCLEAR SCIENCE AND TECHNOLOGY. SECTION 12: NUCLEAR SCIENCE LITERATURE OF THE EASTERN COUNTRIES.
Benno Enselen, comp. (Kernfor Schungsanlage) 1966 198 p refs In GERMAN and ENGLISH
(AED-C-12-13, pT. III)

A list is presented of approximately 750 papers dealing with various aspects of quantum field theory, Regge poles and related topics, cosmic radiation, elementary particles, and radiation detection instruments and methods. NSA

N67-10659# Columbia Univ., New York.
[PARTICLE PHYSICS] Progress Report
J. M. Miller Jun. 1966 10 p refs
(Contract AT(30-1)-1019)
(CU-1019-51) CFSTI: HC $1.00/MF $0.50

Brief descriptions of research carried out during this period are presented for the following: Monte Carlo calculations of intra-nuclear cascades, investigation of Bohr's independence hypothesis by measurements of particle spectra, reaction cross section of an excited nucleus, excitation function for the ^{62}Ni(p,n)^{62}Cu reaction, computer program for conservation of angular momentum in compound-nucleus reactions, the ^{4}He(p,2p)^{3}H reaction at high energies, and decay schemes of ^{201}Bi, ^{202}Bi, ^{203}Bi, and ^{204}Bi. NSA

N67-10661# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Neutronenphysik und Reaktortechnik.
INTERPOLATION FORMULA FOR SELF-SHIELDING FACTOR [INTERPOLATIONSFORMEL FUER SELBSTABSCHIRMUNGS-FAKTOREN]
E. Kiefhaber and K. Ott Dec. 1965 10 p refs In GERMAN Sponsored in part by EURATOM
(KFK-384)

Some considerations on the neutron self-shielding factors of various materials in use at Karlsruhe are outlined and an interpolation formula for these factors is derived from the group constants calculations published by the Russians. The arguments leading to the choice of materials are presented and the various accuracy considerations are discussed. NSA

N67-10663# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
STUDY OF THE PULSATION OF AN ION ACCELERATOR FURNISHING 20-NANOSECOND PULSES [ETUDE DE LA PULSATION D'UN ACCELERATEUR D'IONS FOURNISSANT DES IMPULSIONS D'UNE DUREE DE 20 NANO-SECONDES
Bertrand de Cosnac (Ph.D. Thesis--Paris Univ.) 1966 57 p refs In FRENCH
(CEA-R-2936)

In order to measure fast neutron spectra by the time-of-flight method, a pulsed ion-source which has been placed on a 600kV electrostatic accelerator was studied. Examined successively were the ion-source itself, its extraction device, the focusing equipment, and the pulsation system constituted by a slit which is swept by the beam. Using this ion-source it is possible to obtain a direct current of deuterons of over 800 μA, and clouds having a duration which can be adjusted to between 15 and 40 nanoseconds. Author (NSA)

N67-10664# Instituto de Energia Atomica, Sao Paulo (Brazil). Divisao de Fisica Nuclear.
NEW METHOD OF UTILIZATION OF NaI (T1) CRYSTALS IN DETECTION OF HIGH-ENERGY GAMMA RAYS [UNE NOUVELLE METHODE D'UTILISATION DES CRISTAUX DE NaI (T1) DANS LA DETECTION DE RAYONS GAMMA DE HAUTE ENERGIE]
Manoel Americo Nogueira de Abreu (Comm. a l'Energie Atomique, Saclay, (France), and J. H. Nifenecker Dec. 1965 26 p In FRENCH; ENGLISH summary Prepared Jointly with Comm. a l'Energie Atomique
(IEA-108)

The detection of high energy gamma rays (E>2 Mev) with NaI(T1) crystals is very complex due to the fact that one or two gamma rays of 511 Kev, from pair annihilation, or the primary gamma ray, after Compton scattering, can escape from the crystal. If only the gamma rays that lose a great part of their energy in the central region of the crystal are observed, assuming that the partial interaction occurs mainly at the crystal surface, only gamma rays losing their whole energy in the crystal, will be detected. Theoretical considerations for the detection of high energy gamma rays, taking into account the shape of the spectrum and its efficiency are presented with the experimental data. Author (NSA)

N67-10666# Bettis Atomic Power Lab., Pittsburgh, Pa.
A VARIATIONAL PRINCIPLE FOR THE NEUTRON DIFFUSION EQUATION USING DISCONTINUOUS TRIAL FUNCTIONS
A. J. Buslik Dec. 1965 14 p refs Presented at the Am. Nucl. Soc. Meeting, Denver, Jun. 1966
(Contract AT(11-1)-GEN-14)
(WAPD-T-1885; CONF-660606-13) CFSTI: HC $1.00/MF $0.50

Selengut and Wachspress have developed a variational principle for the neutron diffusion equation which permits the use of discontinuous trial functions. Another variational principle is described which is useful with a wider class of trial functions. NSA

N67-10667# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
NON-NEGATIVITY OF A POLARIZATION MATRIX OF DENSITY [O NEOTRITSATEL'NOSTI POLYARIZATISIONNOI MATRITSY PLOTNOSTI]
M. S. Marinov 1965 8 p refs In RUSSIAN; ENGLISH summary
(Rept.-394)

The condition on a density matrix ρ to have no negative eigenvalues is given in terms of the invariants Sp ρ^k. ($k\leq n$; n is the order of $\rho=2j+1$ for spin j.) Thus, besides the well known inequality Sp $\rho^2\leq1$, there are still $(2j-1)$ inequalities. Sp ρ^k is a polynomial of polarization moments, coefficients being some combinations of Clebsch- and Racah-symbols. As a result, one has $2j$ inequalities satisfied by polarization moments. Author (NSA)

N67-10668# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
QUANTUM FIELD THEORY WITH INDEFINITE METRICS IN HILBERT SPACE [KRANTOVAYA TEORIYA POLYA S INDEFINITNOI METRIKOI V GIL'BERTOVOI PROSTRANSTVE]
A. D. Galanin 1965 24 p refs In RUSSIAN; ENGLISH summary
(Rept.-395)

A system of equations in functional derivatives was plotted for the four-fermion interaction provided the anticommutator in

the cone vertex is C-number, its dependence on the coordinates being not concretized. Proceeding from the formal solution of these equations in the form of continual integral, it is shown that the exclusion of δ–functions from the commutation relations which is possible at indefinite metrics, must not mean the exclusion of any singularities of the anticommutator in the cone vertex. Other wise, it identically vanishes in the whole space. It is pointed out that the generalization of usual interpretation of continual integral from the mechanical system on the field, leads to the restrictions on commutation relations. In particular, it forbids canonic quantization in the case of four-fermion interaction. To describe the anitmommutation singularity in the cone vertex, a new generalized function should be introduced. This function is determined by integration rules with the functions which are singular solutions of the classical field equation. The scheme enclosed is not hamiltonian since it is impossible to plot the total system of commuting operators on the spatially similar surface. Author (NSA)

N67-10675# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
INFLUENCE OF ABSORPTION CORRECTIONS ON PERIPHERAL PHOTOPRODUCTION PROCESSES [EINFLUSS VON ABSORPTIONSKORREKTUREN AUF PERIPHERE PHOTOERZEUGUNGSPROZESSE]
K. Schilling (Physik. Staatsinst.) Apr. 1966 64 p refs In GERMAN; ENGLISH summary
(DESY-66/9)

Photoproduction of pions and vector mesons and the joint photoproduction of vector mesons and the first π-N resonance on nucleons are considered in the peripheral model. Absorptive final-state interactions are taken into account. The differential cross section and the spin state density matrices of the resonances are calculated and compared with experimental data. Author (NSA)

N67-10678# International Centre for Theoretical Physics, Trieste (Italy).
HADRON FORM FACTORS ACCORDING TO SL(6,C)
G. Cocho, C. Fronsdal, Harun Ar-Rashid, and R. White 12 Jul. 1966 8 p refs Submitted for publication
(IC-66/84)

The calculation of the charge form factor of the pion according to SL(6,C) is reported. Results indicate existence of a large charge radius. NSA

N67-10679# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
HYPOTHESIS OF CONSERVED TENSOR CURRENTS AND SU(6) GROUP [SOKHRANYAYUSHCHIESYA TENZORNYE TOKI I RELYATIVISTSKAYA STRUKTURA GRUPPY SU(6)]
V. I. Ogievetskii and I. V. Polubarinov 1966 40 p refs In RUSSIAN
(JINR-P-2696)

It is shown that conserved tensor currents generate SU(6) transformations. A relation is established between the constructed currents and the so-called algebra of currents. The relativised transformations of 35–56–189 plet quarks obtained leave free equations invariant, but should be modified in the case of interaction. In the true theory involving interaction the transformations and currents are likely to become essentially nonlinear. Only if applied to one-particle states and static effects a future true group will be reduced to SU(6). Under the hypothesis that tensor currents are essentially sources of 2^+ fields the fundamental role of the 189 supermultiplet is pointed out. Author (NSA)

N67-10680# California Univ., Los Angeles. Dept. of Physics.
[PARTICLE PHYSICS] Annual Progress Report, 1 Jun. 1965–10 May 1966
Roy P. Haddock 10 May 1966 10 p refs
(Contract AT(11-1)-34)
(MPG-66-6; TID-23206) CFSTI: HC $1.00/MF $0.50

Continuing progress is described for the following research studies: analysis of 2nγ data taken from $\pi^- + d \rightarrow 2n + \gamma$ experiment, K^+ decay spectra, slow π^- reactions in hydrogen, time reversal invariance in $K_{\mu 3}$ mode of the K_2^0 meson, and polarized proton targets. No significant data are given. NSA

N67-10687# California Inst. of Tech., Pasadena.
$p\bar{p}$ ANNIHILATION IN FLIGHT TO MESON AND ELECTRON PAIRS
B. Barish, D. Fong, R. Gomez, D. Hartill, J. Pine et al 22 Apr. 1966 16 p refs Presented at Conf. on Two Particle Interaction, New York, 22 Apr. 1966 Prepared in cooperation with Brookhaven Natl. Lab. and Stanford Univ.
(Contract AT(11-1)-68)
(CATL-68-70; CONF-660425-1)

Cross sections for the reactions of $p+\bar{p} \rightarrow e^+ + e^-$ and $\bar{p}+p \rightarrow \pi^+ + \pi^-$ are measured at 1.5 to 2.5 Bev/c and 1.0 to 1.75 Bev/c, respectively. NSA

N67-10688# Virginia Univ., Charlottesville. Dept. of Aerospace Engineering and Engineering Physics.
THE INTERACTION OF HEAVY KeV IONS WITH GASES Progress Report, 1 Jun. 1965–31 May 1966
John W. Boring 31 May 1966 20 p refs
(Contract AT(40-1)-2911)
(ORO-2911-7; EE-3930-103-66) CFSTI: HC $1.00/MF $0.50

A theoretical investigation was made to improve the calculations of energy ultimately given to the atom or the stopping gas by using a Thomas–Fermi model for obtaining elastic scattering cross sections and for using a simple model for calculating the number of electrons ejected in an inelastic collision and a corresponding value of the average energy required to produce an ion pair. Calculations are given for several ion collisions with argon and nitrogen gases. NSA

N67-10694# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
ξ PHOTOPRODUCTION CROSS SECTION FOR INCIDENT PHOTON ENERGIES 800 TO 1000 MeV
C. Bacci, C. Mencuccini, G. Penso, G. Salvini (Rome Univ.) and V. Silvestri 20 Mar. 1966 30 p refs Submitted for Publication *Its* Nota Interna No. 318
(LNF-66/20)

Photoproduction cross section of the η particle for incident photon energies K from ≈800 to ≈1000 Mev was measured at the 1.1 Bev Frascati electronsynchrotron. The differential cross section for this purpose, at c.m. angle of the η of ≈110°, turns out to be fairly constant for 830 Mev≤K≤900 Mev, and drops down a factor 5 to 10 at K=950 Mev. These results are discussed in terms of a comparison with the data on the production of η's by pions, and with the data on pion-nucleon scattering and pion photoproduction. The conclusions are in agreement with the hypothesis that the η-N system is dominated at low energies by a resonance with orbital angular momentum $1 = o_{1/2}(S_{1/2}$, resonance). Author (NSA)

N67-10695# International Centre for Theoretical Physics, Trieste (Italy).
EIGENFUNCTION EXPANSIONS ASSOCIATED WITH THE SECOND-ORDER INVARIANT OPERATOR ON HYPERBOLOIDS AND CONES
N. Limic, J. Niederle, and R. Raczka Jun. 1966 38 p refs Submitted for Publication
(IC-66/62)

The eigenfunction expansions associated with the second order invariant operator on hyperboloids and cones are derived. The global unitary irreducible representations of the $SO_0(p,q)$ groups

related to hyperboloids and cones are obtained. The decomposition of the quasiregular representations into the irreducible ones is given and the connection with the Mautner theorem and nuclear spectral theory is discussed. Author (NSA)

N67-10696# Ceskoslovenska Akademia Ved, Rez. Ustav Jaderneho Vyzkumu.
THE EFFECT OF D. C. DEE VOLTAGE IN A CYCLOTRON ON INITIAL ION TRAJECTORIES
A. Hrda, K. Kult, and M. Kuzmiak Feb. 1966 10 p refs
(UJV-1408/66)

The presence of a d-c electric field between the cyclotron dees at the same time with the h-f field causes a shift of the stationary orbits parallel to the dee edge. Owing to this shift the ion energy of the external beam may be decreased. It is shown that the shape change of the initial ion trajectory in a cyclotron is due to the d-c dee bias. Author (NSA)

N67-10698# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DETERMINATION OF THE SYNCHROCYCLOTRON ACCELERATING VOLTAGE USING THE INTENSITY DEPENDENCE ON THE FREQUENCY MODULATION [OPREDELENIE USKORYAYUSHCHEGO NAPRYUZHENIYA V SINKHROTSIKLOTRONE S ISPOL'ZOVANIEM ZAVISIMOSTI INTENSIVNOSTI OT CHASTOTY MODULYATSII]
A. N. Safonov 4 Mar. 1966 10 p refs In RUSSIAN
(JINR-P-2730)

A method is described for determination of the accelerating voltage on the synchrocyclotron dee under the operating conditions using the intensity dependence on the frequency modulation. The accelerating voltage in dependence on the direct voltage applied to the anode oscillator tubes is given for the JINR synchrocyclotron. Author (NSA)

N67-10699# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
NEW MEASUREMENTS IN PLUTONIUM L X-RAY-EMISSION SPECTRUM USING AN ELECTRON PROBE MICROANALYZER [NOUVELLES MESURES DANS LE SPECTRE D'EMISSION L DU PLUTONIUM AU MOYEN D'UN MICRO ANALYSEUR A SONDE ELECTRONIQUE]
Jean-Louis Bobin and Jean Despres Apr. 1966 30 p refs In FRENCH
(CEA-R-2921)

A plutonium x-ray spectrum table was established from studies with an electron-probe micro-analyzer. Measurements on plutonium L_{II} and L_{III} levels excitation potentials were achieved. Remarks on apparatus performance data (spectrograph sensitivity, resolving power and accuracy) are included in the appendix. Author (NSA)

N67-10707# Atomic Weapons Research Establishment, Aldermaston (England).
SWANTIME: A TIME-DEPENDENT MULTI-GROUP DIFFUSION CODE FOR THE IBM-7030
A. Brickstock, A. R. Davies, and I. C. Smith May 1966 41 p refs
(AWRE-O-3/66) HMSO: 6s

SWANTIME is a code for solving the time-dependent multigroup diffusion equations in one dimension. Spherical geometry only is allowed. It is intended primarily to follow the response to a neutron pulse injected into a system with short prompt neutron lifetime. Delayed neutron effects are not included. NSA

N67-10717# International Centre for Theoretical Physics, Trieste (Italy).
ALGEBRA OF CURRENTS AND P-WAVE NON-LEPTONIC HYPERON DECAYS
Fayyazuddin and Riazuddin Jun. 1966 13 p refs Sponsored by AEC Revised
(IC-66/73)

It is shown that the chiral SU(3) $\otimes$ SU(3) algebra of currents and the partially conserved axial vector current hypothesis do not lead (in the current-current picture) to $\Delta I = 1/2$ rule for the p-wave Λ and ξ decays nor to pseudo $\Delta I = 1/2$ rule for the p-wave Σ decay contrary to what was obtained for the s-wave decays. Instead one only obtains some relations among deviations from the $\Delta I = 1/2$ rule and deviation from the Lee-Sugawara sum rule. Author (NSA)

N67-10719# Purdue Univ., Lafayette, Ind.
[EXPERIMENTAL PHYSICS PROGRAM AND DATA ANALYSIS SYSTEM] Annual Progress Report, 1 Jun. 1965-31 May 1966
31 May 1966 26 p refs
(Contract AT(11-1)-1428)
(COO-1428-16) CFSTI: HC $2.00/MF $0.50

The experimental physics research during this period consisted of analysis of 2.7-Bev/c π^- p 4-pronged events, 2.7 Bev/c π^- p 2-pronged events, 4.2-Bev/c π^- p 2-pronged events, and 5.0-Bev/c π^- p strange particles. The recoil proton polarization in π^+ p elastic scattering is also briefly discussed. The data analysis program deals with: on-line measuring and reconstruction programming, SMP optical calibrations, SMP diagnostics, and 7044 systems programming. Further programming developments are reported. NSA

N67-10720# California Univ., Berkeley. Lawrence Radiation Lab.
THE A_1 AND K (1320) PHENOMENA—KINEMATIC ENHANCEMENTS OR MESONS?**
Gerson Goldhaber and Sulamith Goldhaber Mar. 1966 66 p refs Submitted for Publication
(Contract W-7405-ENG-48)
(UCRL-16744; CONF-660103-1) CFSTI: HC $3.00/MF $0.75

The similarity between the well-known A_1 phenomenon and the more recently discovered K** (1320) phenomenon is discussed. The assignment of kinetic enhancements or mesons to these phenomena are investigated. NSA

N67-10726# California Univ., Berkeley. Lawrence Radiation Lab.
A STUDY OF MULTI-CHANNEL DYNAMICS IN THE STRIP APPROXIMATION
Shu-yuan Chu (Ph.D. Thesis) 13 May 1966 55 p refs
(Contract W-7405-ENG-48)
(UCRL-16874) CFSTI: HC $3.00/MF $0.50

A systematic study of the dynamics of scattering with several coupled two-particle channels is made using the new strip approximation. The existence of a unique solution to the ND^{-1} equations is established from maximal analyticity of the second degree. The method used is an extension of Jones' proof in the single-channel case, making use of an explicit expression for the determinant of D constructed by Gross. The general method is then applied to the particular case of a $\pi\pi$-$K\bar{K}$ two -channel calculation of the ρ-meson, first with fixed-spin particle and then with Reggeized particle exchange as the generalized potential. A detailed discussion of the numerical result is presented with the conclusion that the effect of the inelastic channel ($K\bar{K}$) is not important in the present approximation scheme. Author (NSA)

N67-10729# International Centre for Theoretical Physics, Trieste (Italy).
ON THE ALGEBRAIC FORMULATION OF DYNAMICAL MODELS
G. Bisiacchi (Trieste Univ.) and P. Budini Jul. 1966 18 p refs Submitted for Publication
(IC-66/87)

An algebraic method for the solution of some dynamical problems for a nonrelativistic system with known symmetry

properties is given, in the case of the so-called broken symmetry. Examples of soluble models are given. One of these, based on the non-compact group Sp(6,R), gives a mass formula for baryons depending on three parameters which reproduces the known masses within electromagnetic mass differences. The model implies the relation $(Y^* - \Sigma)/(\Sigma - \Lambda) = (5/2)$ in good agreement with experiment. The mass formula in the model can be considered as an eigenvalue solution of a differential equation in an appropriate Riemannian manifold. Relation with the proposed models and charge algebras is discussed. Author (NSA)

N67-10733# International Centre for Theoretical Physics, Trieste (Italy).
PARTIAL CONSERVATION OF TENSOR CURRENTS AND PAUL: INTERACTION
W. Krolikowski Jun. 1966 11 p refs Submitted for publication (IC-66/70)

It is shown that the form of the partial conservation of tensor currents (PCTC) proposed in some recent papers should be modified if, for the momentum transfer equal to zero, matrix elements of tensor currents have to be finite and vector meson vertices different from zero. Author (NSA)

N67-10735# National Inst. for Research in Nuclear Science, Harwell (England). Electrostatic Generator Group.
ANALYSIS OF ION BEAMS FROM A MERCURY POOL ARC SOURCE
C. W. Trowbridge and N. Allen Sep. 1965 40 p refs
(RHEL-R-115) HMSO: 5s 6d

The identification of ion beams from the mercury pool arc source designed for the Oxford Electrostatic Accelerator were determined. The effect of vapor traps on beam composition was investigated and the ratios of useful beam to impurity beams measured. Author (NSA)

N67-10739# Erlangen Univ. (West Germany) Inst. for Ray Study.
FILM DOSIMETRY OF β RAYS [FILMDOSIMETRIE VON β STRAHLEN]
Margherita Kohlhof Dec. 1965 48 p refs In GERMAN; ENGLISH summary
(BMWF-FBK-65-08)

The response of the Adox Dosis-Doppelfilm to β rays and electrons was studied. Photographic density graphs and sensitivity are reported. It is explained how to determine energy and dose from the density. Two methods to distinguish β rays and soft X-rays are described: separation by backscattering (both kinds of radiation can be distinguished by means of their different degree of backscattering) and separation by absorption (Al- and Cu-filters of the same surface density (mass per unit area) absorb β rays equally, whereas x rays are more absorbed by Cu). Finally the dependence of the density on the angle of incidence of the radiation was investigated. Author (NSA)

N67-10740# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
INVESTIGATION OF CHARGE-EXCHANGE $\pi^- + p \rightarrow \pi^0 + n$ REACTION AT 2.8 GeV/c [ISSLEDOVANIE OBMENNOGO RASSEYANIYA $\pi + p \rightarrow \pi^0 + n$ PRI IMPUL'SE 2.8 GZV/S]
V. V. Barmin, A. G. Dolzolenko, A. G. Meshkovskii, and V. A. Shebanov 1965 15 p refs In RUSSIAN; ENGLISH summary
(ITEF-401)

The reaction $\pi^- + p \rightarrow \pi^0 + n$ was investigated at $p_{\pi^-} = 2.8$ Bev/c. The total cross section for this reaction is $\sigma = 0.35 \pm 0.04$ mb. There are two maximum in the angular distribution $d\sigma/d\Omega$. Besides the first maximum around 0° there is the second one in interval $0.3 < \cos\theta < 0.45$. It is correspondent to the square of the transfer momentum $t \cong -1.4$ (Bev/c)^2. The value $d\sigma/d\Omega$ at 0 and 180° equal 220 ± 30 μb/sr and 5 ± 5 μb/sr, respectively. Author (NSA)

N67-10762# Joint Inst. for Nuclear Problems, Dubna (USSR). Lab. of Neutron Physics.
PARAMETERS OF Pu-239 LEVELS [PARAMETRY UROVNEI PLUTONIYA-239]
Yu. V. Ryabov, Yung-chang Wang, E. Dermendzhiev, and Pei-shu Chang 23 Apr. 1966 18 p refs In RUSSIAN
(JINR-P-2713)

The fission and the radiative capture cross sections of ^{239}Pu were measured by the time-of-flight method with time resolution of about 0.06 μ s/m using the JINR fast pulsed reactor. The cadmium-loaded liquid scintillation detector was used to perform measurements. The values of $\bar{1}_f/\bar{1}_\gamma$ and $g\bar{1}_n$ were obtained by the area method in the neutron energy region up to ~200 ev. Author (NSA)

N67-10766# Brookhaven National Lab., Upton, N. Y.
SOME NON-COMPACT GROUPS ASSOCIATED WITH THE VERTEX OPERATOR
Feza Guersey Jun. 1966 27 p refs Presented at the Conf. on Non-compact Groups in Particle Phys., Milwaukee, 6 May 1966
(Contract AT(30-2)-GEN-16)
(BNL-10387; CONF-660540-2) CFSTI: HC $2.00/MF $0.50

The phenomenological symmetries of the baryon-antibaryon-meson vertices and the hypothetical symmetries of quark-antiquark-meson vertices are discussed with remarks on meson-meson-meson vertices. No attempt is made to base such symmetries on field theoretical models or saturation properties of current commutators. NSA

N67-10770# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Kernaphysik.
ON THE APPLICATION OF LITHIUM-DRIFTED GERMANIUM DIODES IN NEUTRON CAPTURE GAMMA RAY SPECTROSCOPY
W. Michaelis and H. Schmidt Jun. 1966 15 p refs Presented at the Intern. Atomic Energy Agency Panel Meeting on use of Lithium-drifted Germanium Gamma Ray Detectors for Res. in Nucl. Phys., Vienna; 6–10 Jun. 1966
(KFK-429) CONF-660625-2)

A status report is presented on the application of lithium-drifted germanium diodes in neutron capture gamma ray spectroscopy. The report includes a summary of the research being done at Karlsruhe on neutron capture. A review of the capabilities and limitations in the application of germanium diodes, and indications of trends in future applications. NSA

N67-10774# Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
STUDY OF THE REACTIONS (e,e'p), (e,e'n) AND (e,e'α) USING THE EXTRACTED BEAM OF THE FRASCATI ELECTRON SYNCHROTRON [STUDIO DELLE REAZIONI (e,e'p), (e,e'n), (e,e'α) UTILIZZANDO IL FASCIO ESTRATTO DELL' ELETTROSINCROTRONE DI FRASCATI (PROPOSTS D'ESPERIENZA)]
G. Campos Venuti, G. Cortellessa, E. De Sanctis, G. Farchi, S. Frullani et al 10 May 1966 64 p refs In ITALIAN
(ISS-66/20)

On the basis of the results obtained with (e,e'p) experiments, using the internal beam of the Frascati electron-synchrotron, a new experiment is proposed, using the external beam, to study the reactions (e,e'p), (e,e'n) and (e,e'α). After discussing the study of these reactions within the framework of nuclear physics research, different experimental solutions for detecting scattered particles and their advantages and disadvantages are examined. Due to the complexity of the measurements and the data reduction, the logic of the experiment is discussed. Finally, an estimate of the expected counting rate and the unavoidable accidentals is presented. Author (NSA)

N67-10776# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
RESPONSE MATRICES IN THE DOUBLE P_N APPROXIMATION OF NEUTRON TRANSPORT THEORY
J. J. Thompson Feb. 1966 12 p refs
(AAEC-E-149)

Relations are derived for reflection and transmission matrices of slabs in the double P_N approximation which permit their evaluation without the determination of particular eigenvalues and eigenvectors for each problem. Invariance principles also lead to results analogous to those of Chandrasekhar in his classical theory of radiative transfer. Author (NSA)

N67-10778# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
PROTON POLARIZATION FROM THE $^{12}C(He,p_0)^{14}N$ REACTION [POLYARIZATSIYA PROTONOV IZ REAKTSII $^{12}C(^3He,p_0)^{14}N$]
R. Frauze, I. V. Sizov, and G. Eler 4 May 1966 12 p refs In RUSSIAN
(JINR-P-2725)

The left–right asymmetry in elastic scattering of protons from the $^{12}C(He-3,p_0)^{14}N$ reaction on carbon was measured using an electrostatic generator accelerating the ^3He ions. From the asymmetry measured the proton polarization is calculated at $E_{^3He}=2.95$ Mev. The polarization is found to be -0.43 ± 0.05; -0.27 ± 0.04; $+0.09\pm0.04$ for the laboratory system angles 45, 90, 135°, respectively. Author (NSA)

N67-10801# Case Inst. of Tech., Cleveland, Ohio.
AN EXPERIMENTAL TEST OF THE LAW OF BARYON CONSERVATION
Henry S. Gurr (Ph.D. Thesis) Nov. 1966 89 p refs
(Contract AT(11-1)-818)
(COO-818-87) CFSTI: HC $3.00/MF $0.75

A 162 m^2 steradian scintillation detector located 3200 m below surface was used to look for high energy fragments from baryon nonconserving nucleon decay. A lower limit on the lifetime on the nucleon from 2×10^{28} to 8×10^{29} years, depending on the assumed decay mode, is established. Author (NSA)

N67-10802# Brookhaven National Lab., Upton, N. Y. Accelerator Dept.
HIGH FIELD SUPERCONDUCTING MAGNETS
W. B. Sampson 20 Jun. 1966 18 p refs Presented at Intermag Conf., Stuttgart, Apr. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10380; AADD-111; CONF-660436-1) CFSTI: HC $1.00/MF $0.50

Recently a better understanding of the effects of magnetic and thermal transients has led to techniques of superconducting magnet construction with large solenoids which are not subject to current degradation. These techniques are discussed with particular reference to very high-field solenoids (greater than 100 kG) and the possibilities presented by currently available superconductors are indicated. Applications to high-energy physics are considered and existing problems are reviewed. NSA

N67-10803# Case Inst. of Tech., Cleveland, Ohio. Dept. of Physics.
NEUTRINOS UNDERGROUND
Frederick Reines Apr. 1966 15 p Presented at Am. Phys. Soc. Meeting, Washington, D. C.
(Contract AT(11-1)-818)
(COO-818-86; CONF-660411-33) CFSTI: HC $1.00/MF $0.50

An experiment is described in which the interaction of high-energy neutrinos at a distance of 10,492 feet below ground was detected. The description includes the source, detector, background reduction, data recording, data, backgrounds in the ν_μ aperture, expected signal, mass of the W, and future plans. NSA

N67-10805# India. Dept. of Atomic Energy, Bombay.
[ATOMIC ENERGY RESEARCH ACTIVITIES] Annual Report, 1965–1966
1966 60 p
(NP-16171)

A review of activities in the nuclear power development programs is presented. Research and development at Trombay was concerned with reactors, nuclear physics, equipment and instruments, electronics, health physics, chemical engineering, fuel processing, metallurgy, radiation chemistry and isotopes, biology, and radiation medicine. Activities at the Tata Institute of Fundamental Research include advanced mathematics studies, theoretical physics studies, investigations of nuclear structure and magnetism, high altitude investigations using balloons, air shower measurements, natural water analyses for tritium, and syntheses of biological macromolecules. The activities at other research institutions are also briefly reviewed. At Saha Institute the effects of radiation on DNA in cells was studied. At Tata Memorial Hospital P^{32} was used to detect cancer of the nose and throat. Space research is discussed briefly. Activities in the Atomic Minerals Division included development of promising U deposits, and prospecting for U, Th, Be and other atomic minerals. Developments at the Tarapur and Rajusthan Atomic Power Projects are reviewed. NSA

N67-10810# Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany). Zentralinstitut fuer Kernforschung.
ABSOLUTE CALIBRATION OF NEUTRON SOURCES BY THE MANGANESE SULFATE METHOD [ABSOLUTEICHUNG VON NEUTRONENQUELLEN NACH DEM MANGANSULFATVERFAHREN]
Karl-Heinz Faehrmann Feb. 1966 17 p refs In GERMAN; ENGLISH summary
(ZFK-RN-33)

After a brief discussion of the principles of the method the special chosen measuring assembly and the method of detector calibration by means of $4\pi\beta$ measurements are described. The method which is checked by the calibration of a standard-source allows the calibration of neutron sources with an accuracy of $\leq 2\%$. The smallest measurable source strength is about 1.10^4n/sec. Author (NSA)

N67-10815# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
ON CIRCULAR POLARIZATION MEASUREMENTS IN γ–γ PERTURBED ANGULAR CORRELATIONS
E. G. Beltrametti 21 Feb. 1966 7 p refs
(RT-FI-(66)8)

The role of circular polarization measurements in γ–γ perturbed angular correlations is examined. It is shown, in particular, how the inapplicability of unpolarized correlations in searching for g-factors of spin-1/2 excited nuclear states, can be removed by allowing circular polarization detection. Author (NSA)

N67-10818# Brookhaven National Lab., Upton, N. Y.
TESTS OF UNITARITY SYMMETRY IN NUCLEI BY NUCLEUS–HYPERNUCLEUS REACTIONS
L. S. Kisslinger Jul. 1966 6 p refs Presented at the Intern. Conf. on Nucl. Phys., Berkeley, Calif., 12–17 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10420; CONF-660913-1) CFSTI: HC $1.00/MF $0.50

A study is presented on meson-nucleus reactions in order to estimate the cross sections for the various processes and to determine which of these, if any, are suitable for an experimental test of the existence of new analog states as approximate eigenstates. NSA

N67-10819# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

DOUBLE CHARGE EXCHANGE OF 50-MeV TO 176-MeV π^- MESONS IN PHOTO EMULSION [DVOINAYA PEREZARYADKA π^--MEZONOV S ENERGIEI 50–176 MeV V FOTOEMUL'SII]

Yu. A. Batusov, S. A. Bunyatov, G. Ionitse, E. Loznyanu, V. Mikhul et al 1966 5 p refs In RUSSIAN
(JINR-P-2806)

Total cross section measurements were made for double charge exchange of 50 to 176 MeV π^- mesons in photo emulsions. Author (NSA)

N67-10828# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MUON CAPTURE IN MIXED GASES [ZAKHVAT MYUONOV V SMESYAKH GAZOV]

Yu. G. Budyashov, V. G. Zinov, A. D. Konin, and A. I. Mukhin 1966 9 p refs In RUSSIAN Submitted for Publication
(JINR-P-2788)

The probability of nuclear capture of nuons in mixed single atom (helium and neon) and multi-atom (nitrogen and carbon oxide) gases in relation to argon was measured using μ-x radiation recordings. The study did not exhibit any systematical relation between the probability of capture and nuclear charge which is another indication of the influence of molecular size on nuclear capture. Author (NSA)

N67-10830# Maryland Univ., College Park. Dept. of Physics and Astronomy.

LECTURES ON HIGH ENERGY SCATTERING

R. J. Eden [1966] 118 p refs
(NP-16231)

A series of lectures is presented on high energy scattering. Topics discussed are experimental survey, theoretical background and assumptions, bounds for total cross sections, bounds for nonforward scattering, crossing symmetry and analyticity in energy, dispersion relations, partial wave amplitudes, and relations for cross sections for different processes. (NSA

N67-10831# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

CHARGE OF π-MESONS STOPPED ON LIGHT NUCLEI [PEREZARYADKA OSTANOVIVSHIKHSYA π-MEZONOV NA LEGKIKH YADRAKH]

V. I. Petrukhin, Yu. D. Prokoshkin, and A. I. Filippov 1966 5 p refs In RUSSIAN
(JINR-P-2780)

Measurements were made of the charge exchange of π^- mesons stopped on 3He nuclei. The charge exchange of the stopped π^- mesons on ^{10}B, ^{14}N, and ^{35}Cl was depressed by 10^4 folds. Author (NSA)

N67-10836# Carnegie Inst. of Tech., Pittsburgh, Pa.

APPLICATION OF THE BETHE-SALPETER EQUATION TO THE STATIC BOOTSTRAP MODEL

Keh-Ying Lin May 1966 164 p refs
(Contract AT(30-1)-882)
(CAR-882-19) CFSTI: HC $5.00/MF $1.00

The bootstrap equations derived from the Bethe–Salpeter equations with ladder approximation are applied to the static models of baryons. An approximation similar to the effective range approximation is made in the static model, and a set of algebraic equations which are convenient for numerical calculation are obtained. Among the models considered, one is the well-known π-N-N* static model, for which a unique self-consistent solution is obtained which fits the experimental data quite well by choosing a suitable cutoff. A similar result is obtained if SU(3) symmetry is assumed, and the so-called F-D mixing angle of the coupling constants turns out to be approximately 38°. A static model is considered which includes π, K, N, N*, Y_1^*, Σ, and Λ in which no self-consistent solution is found. The bootstrap equations in this method are similar to those obtained from the N/D method except that the normalization equations are somewhat different. Author (NSA)

N67-10843# Brookhaven National Lab., Upton, N. Y.

ELASTIC SCATTERING OF 1 BeV PROTONS FROM HELIUM AND OXYGEN

G. J. Igo, J. L. Friedes, H. Palevsky, R. J. Sutter, G. W. Bennett et al Jul. 1966 9 p refs Presented at the Intern. Conf. on Nucl. Phys., Gatlinburg, Tenn., 12–17 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10438; CONF-660906-7) CFSTI: HC $1.00/MF $0.50

An experiment is described on elastic scattering of 1-BeV protons from helium and oxygen in the laboratory angular range 3°–42° and 3°–22° respectively. Data obtained from the experiment are presented. NSA

N67-10845# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

CAPTURE OF PIONS BY ^{3}He. PART II: NUCLEAR DECAY REACTIONS [IZUCHENIE ZAKHVATA PIONOV GELIEM-3. II: REAKTSII S RAZVALOM YADRA]

O. A. Zaimidoroga, M. M. Kulyukin, R. M. Sulyaev, A. I. Filippov, I. V. Falomkin et al 1966 15 p refs In RUSSIAN Submitted for Publication
(JINR-P-2805)

A high pressure diffusion chamber was used in the investigation of π meson capture by ^{3}He leading to the processes of nuclear decay. Relative probabilities of these processes and the pulse spectra of the secondary charged particles were measured. NSA

N67-10853# Brookhaven National Lab., Upton, N. Y.

$\pi\pi$ RESONANCES FROM 6 GeV/c π^-p INTERACTION

David J. Crennel, Paul V. C. Hough, George R. Kalbfleisch et al [1966] 9 p Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 31 Aug.–17 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10460; CONF-660808-1) CFSTI: HC $1.00/MF $0.50

Evidence is presented for both charged and neutral $\pi\pi$ enhancements in the mass region 1600–1800 Mev from the reactions $\pi^-p \rightarrow \pi\pi N$ at 6 Bev/c. In the $\pi^+\pi^-$ state an enhancement centered at 1700 Mev with a width of the order of 200 Mev was observed. The $\pi^-\pi^0$ system is shown to have a somewhat narrower peak at 1625 Mev with a width of about 60 Mev. NSA

N67-10855# Commissariat a l'Energie Atomique, Sacaly (France). Centre d'Etudes Nucleaires.

STUDIES ON THE GAMMA–GAMMA METHOD. DEVELOPMENT OF AN APPARATUS FOR ON-THE-SPOT MEASUREMENT OF URANIUM ORE DENSITIES [ETUDES SUR LA METHODE GAMMA–GAMMA. DETERMINATION D'UN APPAREILLAGE POUR LA MESURE EN PLACE DE LA DENSITE DES MINERALS D'URANIUM]

Jan A. Czubek (Polish Acad. of Sci., Cracow) and Jean Guitton Apr. 1966 72 p refs In FRENCH
(CEA-R-2919)

Experimental results obtained on graphite using the gamma–gamma probe are presented along with data for calibration curves. Parameters of scattered radiation energy spectra and calibration curves were studied along with radioactive sources, probe areas, source-detector distances, and shielding. Mathematical models of calibration curves were developed and optimization of the probe was achieved. NSA

N67-10856# Instituto de Energia Atomica, Sao Paulo (Brazil). Divisão de Fisica de Reactores.

LEAST SQUARES METHOD USING A LINEAR COMBINATION OF EXPONENTIALS [MINIMOS QUADRADOS PARA COMBINACAO LINEAR DE EXPONENCIALS]

Myrian de Carvalho Paiano and J. Max Cohenca Nov. 1965 15 p refs In PORTUGUESE; ENGLISH summary
(IEA-106)

The least squares method using a linear combination of exponentials has been often used in analysis of decay curves coming from pulsed neutron experiments. The decay curves are fitted by a linear combination of exponentials plus a constant background. The method may be used to study the decay of any mixture of radioactive isotopes, with the following restrictions; the maximum number of experimental points is 200; the maximum number of exponentials is 10; and the points are equally spaced on the time axis, which is considered free of errors. The least squares method described by Keepin is used. The program is based on Moscati's program. Author (NSA)

N67-10901# Stichting voor Fundamenteel Onderzoek der Materie, Utrecht (Netherlands).

MUON CAPTURE IN LITHIUM

Adrianus Lodder (Ph.D. Thesis—Vrije Univ.) 1966 92 p refs Supported by the Netherlands Organ. for Sci. Res.
(NP-16190)

A discussion is presented of the expression suitable for total muon capture calculations. The method of the closure approximation is described. The pertaining formulas and wave functions are given for application of this method to ^{6}Li and ^{7}Li. The results for this method give rise to the conclusion, that for ^{6}Li there is agreement between theory and experiment, while for ^{7}Li there is a discrepancy. However, the unreliability of the closure approximation and results from application of the Z^{4}_{eff}-law create the expectation that this conclusion might be just the reverse. The giant resonance method is described. The formulas for this semiempirical method are derived and discussed. NSA

N67-10902# Tokyo Univ. (Japan). Inst. for Nuclear Study.

MEASUREMENT OF GAMMA RAYS FROM (p,2n) REACTIONS ON VIBRATIONAL NUCLEI

Hiroyasu Ejiri, Masayasu Ishihara, Takashi Inamura, and Kenji Katori 26 Apr. 1966 28 p refs
(INSJ-98)

Gamma rays from the (p,2n) reaction with 14.3-Mev proton on the vibrational nuclei were measured using a lithium drifted germanium semiconductor detector. The targets used were ^{103}Rh, ^{109}Ag, ^{121}Sb, ^{139}La and ^{197}Au. The properties of the gamma transitions were determined from their relative intensities and conversion coefficients by taking into account the previous results of the conversion electrons. The anisotropy of the gamma emission was measured and the degree of the spin alignment of the residual excited state was discussed in terms of the spin alignment in nuclear reaction. Author (NSA)

N67-10904# Brookhaven National Lab., Upton, N. Y.

SOME PROPERTIES OF K* (1425)

David J. Crennell, George R. Kalbfleisch, Kwan Wu Lai, J. Michael Scarr, Thomas G. Schumann et al [1966] 5 p Presented at the 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 31 Aug.–7 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10462; CONF-660808-3) CFSTI: HC $1.00/MF $0.50

Determinations of the mass, width, and some quantum numbers of the K* (1425) produced in 6 BeV/c π-hydrogen reactions are reported. The interactions $\pi^{-}p \rightarrow \Lambda K^{+}\pi^{-}$ and $\pi^{+}p \rightarrow \Lambda K^{+}\pi^{+}$ were considered. NSA

N67-10905# Brookhaven National Lab., Upton, N. Y.

RESONANCE PRODUCTION IN THE REACTIONS $\pi^{+}p \rightarrow$ KKN AT 6 GeV/c

David J. Crennell, George R. Kalbfleisch, Kwan Wu Lai, J. Michael Scarr, Thomas G. Schumann et al [1966] 8 p refs Presented at 13th Intern. Conf. on High Energy Phys., Berkeley, Calif., 31 Aug.–7 Sep. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10461; CONF-660808-2) CFSTI: HC $1.00/MF $0.50

Resonance production in the KKN final states from $\pi^{+}p$ interactions at 6 Bev/c is reported. The data were obtained from exposures of the BNL 80-inch liquid hydrogen bubble chamber. NSA

N67-10907# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

$\pi^{+}-p$ INTERACTIONS AT 900 MeV

Wesley James Metzger (Ph.D. Thesis) 1966 136 p refs
(Contract AT(30-1)-875)
(UR-875-151) CFSTI: HC $4.00/MF $1.00

The BNL 20-inch liquid hydrogen bubble chamber was exposed to a separated beam of π^{+} mesons at 1.02 Bev/c. 6000 events were found and measured. Cross sections for the following reactions were measured: $\pi^{+}p \rightarrow \pi^{+}p$ (10.7±0.4 mb.), $\pi^{+}p \rightarrow \pi^{+}p\pi^{0}$ (9.2±0.2 mb.), $\pi^{+}p \rightarrow \pi^{+}pe^{+}e^{-}$ (0.11±0.04 mb.), $\pi^{+}p \rightarrow \pi^{+}\pi^{+}n$ (1.9±0.1 mb.), $\pi^{+}p \rightarrow$ 2 charged particles +2 or more neutrals (0.74±0.08 mb.), and $\pi^{+}p \rightarrow$ four charged particles (0.53±0.04 mb.). The differential cross section for elastic scattering was measured. The forward part was compared to the optical model and an exponential in the square of the four-momentum transfer. The reactions yielding $\pi^{+}p\pi^{0}$ and $\pi^{+}\pi^{+}n$ were found to be dominated by production of the N*(1236) isobar. The invariant mass spectra of $\pi^{+}p \rightarrow \pi^{+}p_{+}\pi^{0}$ were fit to the hypothesis that it proceeds via the following intermediate states $\pi^{+}p \rightarrow \pi^{0}N^{*++}(1236) \rightarrow \pi^{+}p\pi^{0}$ (5.77(+0.26 to −0.27) mb.), $\pi^{+}p \rightarrow \pi^{+}N^{*+}(1236) \rightarrow \pi^{+}p\pi^{0}$ (2.55(+0.23 to −0.26) mb.), $\pi^{+}p \rightarrow \pi^{+}N^{*+}$ (1518) $\rightarrow \pi^{+}p\pi^{0}$ (0.00(+0.09 to −0.00) mb.), and $\pi^{+}p \rightarrow p^{+}p \rightarrow \pi^{+}p\pi^{0}$ (0.40(+0.38 to −0.40) mb.) with the inclusion of some nonresonant phase space background. A Monte Carlo program is used to generate the mass spectra for each of these intermediate states. A linear combination of these is fit to the experimental mass spectra. This resulted in the partial cross sections indicated above in parentheses. The distribution of the invariant mass of the $\pi^{+}-\pi^{0}$ was also compared with the Yodh–Olsson isobar model. NSA

N67-10911# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR).

PROBLEM OF UTILIZING NUCLEAR D(d,n)^{3}He AND T(d,n)^{4}He REACTIONS FOR CALIBRATION OF FAST-NEUTRON RADIATION METERS [K VOPROSU OB ISPOL'ZOVANII YADERNYKH REAKTSII D(d,n)^{3}He I T(d,n)^{4}He DLYA GRADUIROVKI RADIOMETROV BYSTRYKH NEITRONOV]

R. D. Vasil'ev, G. A. Dorofeev, V. I. Petrov, M. I. Primenov, and V. F. Shevchenko 1966 4 p refs In RUSSIAN; ENGLISH summary Prepared Jointly at Moscow and Obninsk
(NP-16204)

A detailed theoretical and experimental description is given of the study of radiometer calibration by neutrons with energies of approximately 2.5 and 14 Mev produced, respectively, by the D(d,n)^{3}He and T(d,n)^{4}He reactions. A diagram shows the target with the proportional counter which accepts neutrons from the NG-200 generator. The neutron radiometer calibration proved in general feasible, and the calibration error evaluated as the sum of mean square errors in the determination of neutron flow densities and the indicators of the meters were between 5 and 10%. NSA

N67-10914# Oak Ridge National Lab., Tenn.
SURVEY OF THE U. S. SHIELDING CALCULATION METHODS AND PROGRAMS
S. K. Penny [1966] 16 p refs Presented at European Nucl. Energy Agency Seminar-Workshop on Computer Programs for Shielding Calculations, Ispra, Italy
(Contract W-7405-ENG-26)
(ORNL-P-2310; CONF-660442-1) CFSTI: HC $1.00/MF $0.50

Changes in the field of shielding calculations and computer techniques are reviewed. The evaluation of different coding systems is discussed and the future of shielding calculational techniques is considered. NSA

N67-10919# California Univ., Berkeley. Lawrence Radiation Lab.
POLARIZATION IN PROTON–PROTON SCATTERING USING A POLARIZED PROTON TARGET. PART I: 0.330 TO 0.740 GeV. PART II: 1.70 TO 6.15 GeV
F. Betz, P. Grannis, O. Chamberlain et al Apr. 1966 14 p refs Presented at Intern. Conf. on Two-body Probl. at High Energy, Stony Brook, N. Y.
(Contract W-7405-ENG-48)
(UCRL-16866; CONF-6604202) CFSTI: HC $1.00/MF $0.50

The results of two experiments to measure the polarization parameter in p–p scattering are reported. Both experiments utilize an unpolarized proton beam incident on a polarized proton target. One experiment was performed at the Berkeley 184-inch cyclotron using incident protons of 328, 614, 679, and 736 MeV kinetic energy. The other experiment was performed at the bevatron and measurements were taken at 1.7, 2.85, 3.5, 4.0, 5.05, and 6.15 BeV kinetic energy. The angular regions measured were from 20° to 100° center of mass; the square of the four-momentum transfer ranged from 0.1 to 0.8 $(BeV/c)^2$. Author (NSA)

N67-10945# McGill Univ., Montreal (Quebec). Dept. of Chemistry.
VARIATION OF NUCLEAR CHARGE DISTRIBUTION IN FISSION WITH BOMBARDING ENERGY Final Report
Leo Yaffe Aug. 1966 6 p refs
(Grants AF-AFOSR-0024-62; AF-AFOSR-489-64)
(AFOSR-66-1763; AD-638005) CFSTI: HC $1.00/MF $0.50

Independent and cumulative cross sections were determined for the formation of a large number of nuclides formed in the fission of U233, U235, U238 and Th232 by protons of energies from 8 to 100 Mev. Charge dispersion curves were constructed. In general the curves broaden with increasing proton energy, attributable to a greater variety of fissionable parents as neutron evaporation becomes more competitive with fission. The most probable charge formed in fission, moves towards stability and neutron-deficient products appear in good yield. Excitation function were constructed for each of the fission products and additional data added to those previously obtained by Friedlander et al (Phys. Rev. v129 p1809 1963). The variation with bombarding energy of the isomer ratio of the metastable to ground state of some of the fission products was studied. Theoretical calculations were made to elucidate the behaviour Author (TAB)

N67-10962# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DIELECTRIC LOSSES SITUATED IN AN IONIZING RADIATION FIELD
V. K. Zhuravlev 6 Jun. 1966 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Fiz. (Tomsk), no. 5, 1964 p 86–90
(FTD-TT-65-398; TT-66-62345; AD-639482) CFSTI: HC $1.00/MF $0.50

The article discusses the relaxation polarization at the effect of ionizing radiation of low intensity, when the irreversible changes in the dielectric can be disregarded. It is shown, that the appearance of hot molecules on account of radiation energy absorption, may lead to acceleration as well as to slow down of dielectric relaxations, and also to an increase or decrease of dielectric losses. Author (TAB)

N67-11004# C-E-I-R, Ltd., London (England).
THE SECOND PHASE OF RESEARCH ON ATOMIC STRUCTURES Final Technical Report
D. F. Mayers and F. O'Brien Wright-Patterson AFB, Ohio, ARL, Jun. 1966 73 p refs
(Contract AF 33(615)-2675)
(ARL-66-0109; AD-639311) CFSTI: HC $3.00/MF $0.75

A brief summary is made of the progress toward writing programs for solving the relativistic Hartree-Fock equations and the Hartree-Fock equations with configuration interaction. The possibility of predicting a polarization function for any isoelectronic sequence is discussed with particular reference to the Na I - Ar VIII sequence. Transition integrals for this sequence are presented. Results of an investigation on the form of the polarization function for the case of two electrons outside of closed shells are given. Modifications of a Hartree-Fock program written under a previous contract (see AD-617 705) are described and their Fortran listings are included. Author (TAB)

N67-11118# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.
ATOMIC TRANSITION PROBABILITIES. VOLUME I: HYDROGEN THROUGH NEON—A CRITICAL DATA COMPILATION
W. L. Wiese, M. W. Smith, and B. M. Glennon 20 May 1966 152 p refs
(NSRDS-NBS-4, Vol. I) GPO: $2.50

Atomic transition probabilities for about 4,000 spectral lines of the first ten elements are compiled; and the data are presented in separate tables for each element and stage of ionization. For each ion, the transitions are arranged according to multiplets, supermultiplets, transition arrays, and increasing quantum numbers. Allowed and forbidden transitions are listed separately. For each line, transition probability for spontaneous emission, absorption oscillator strength, and line strength are given; along with spectroscopic designation, wavelength, statistical weights, and energy levels at upper and lower states. Estimated accuracy and source are indicated; and the main justification for the choice of the adopted data and for the accuracy rating are discussed for each ion. A critical review of the major data sources is included. Author

N67-11127# Joint Inst. for Lab. Astrophysics, Boulder, Colo.
FRANCK–CONDON FACTORS FOR THE IONIZATION OF H_2 AND D_2
Gordon H. Dunn 2 Dec. 1965 14 p refs
(JILA-57)

Franck–Condon factors for ionization of $H_2(^1\Sigma_g^+)$ and $D_2(^1\Sigma_g^+)$ are presented for 19 levels in $H_2^+(^2\Sigma_g^+)$ and for 27 levels in $D_2^+(^2\Sigma_g^+)$. Comparisons are made with calculations, using less accurate potential functions for the molecular ion. Vibrational eigenenergies are given for D_2^+. Author

N67-11185# New York Univ., N. Y. Research Div.
ABSOLUTE MEASUREMENTS OF TOTAL CROSS SECTIONS FOR THE SCATTERING OF LOW-ENERGY ELECTRONS BY ATOMIC AND MOLECULAR OXYGEN
Gabriel Sunshine, Bertrand B. Aubrey, and Benjamin Bederson 1 Sep. 1966 39 p refs
(Contract Nonr-285(60))
(AD-639196) CFSTI: HC $2.00/MF $0.50

The atom beam recoil technique was used to measure absolute total cross sections for the scattering of electrons by atomic and molecular oxygen at 22 energies between 0.5 and 11.3 eV, with additional data obtained up to 100 eV. In this

method, a modulated electron beam cross-fires an atom beam, whose attenuation at the modulation frequency is observed. The angular resolution in the electron polar scattering angle ranges from about 15.6 degrees at 1 eV to 9.6 degrees at 12 eV, for O, and from about 18.5 degrees at 1 eV to 11.4 degrees at 12 eV, for O2. Our absolute values for O2 between 0.5 and 11.3 eV are between 10 and 20% higher than those of Bruche, while the shape of the curve agrees well. The atomic cross sections vary from about 5.3 sq. A at 0.5 eV to 8.3 sq. A at 11.3 eV, with an estimated error of 20% except for the 0.5 eV point which has an error of 30%. These results are in excellent agreement with semi-empirical calculations of Cooper and Martin and Robinson and Geltman, as well as with the polarized orbitals calculation of Temkin. (Author) TAB

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N67-10043# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACCELERATION OF A CONDUCTING GAS WITH MINIMUM LOSSES IN DENSE FLUX ELECTROMAGNETIC FIELDS
G. M. Bam-Zelikovich *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 21–34 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

The acceleration of a plasma is investigated for the case when the external magnetic field is much greater than the plasma field. Steady motion of plasma is considered in an axisymmetric channel limited by two conducting walls of variable radius. The case in which the electromagnetic forces are so great that the pressure gradient may be neglected is considered. Expressions are presented for variation problems of plasma acceleration in which the Joule dissipation is at a minimum, for the general case and when the potential difference between the electrodes is a given function of the channel length. N.E.N.

N67-10278# General Dynamics/Convair, San Diego, Calif. Space Science Lab.
ACCELERATION PROCESS IN THE HALL CURRENT DEVICE
Jan Rosciszewski Jun. 1966 19 p refs
(Contract AF 49(638)-1556)
(AFOSR-66-1421; AD-637581) CFSTI: HC $1.00/MF $0.50

A simplified analytical model of the flow process in a Hall current accelerator device is discussed. The initial acceleration from subsonic to sonic velocity (due to both Joule heating and a Lorentz force resulting from an ionizing current effect) leads to plasma temperatures and degrees of ionization of the same order of magnitude as those obtained from experiments. Examination of the expansion of the plasma in the magnetic nozzle shows that the energy of aximuthal motion of the plasma is transformed into axial directed energy. For hydrogen the final exhaust plasma velocity is about 100,000 m/sec Author (TAB)

N67-10287# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.
EXPERIMENTS ON NON-LINEAR PLASMA WAVE INTERACTION
Boris Kerzar and Peter Weissglas 31 May 1966 19 p refs
(Contract AF 61(052)-888)
(SR-7; AFCRL-66-559; AD-637868) CFSTI: HC $1.00/MF $0.50

Non-linear interaction between waves on a low pressure mercury vapour discharge surrounded by a cylindrical wave guide was studied. The waves which were considered are all azimuthally symmetric. By proper choice of propagation direction and frequency of the primarily generated waves it was possible to generate both slow and fast waves by means of the non-linear interaction Author (TAB)

N67-10300# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
THE APPLICATION OF A LANGMUIR TYPE PROBE AND MICROWAVE DIAGNOSTIC TECHNIQUE TO TRANSIENT IONIZED FLOWS
Samuel Lederman, Daniel S. Wilson, and Edward F. Dawson Aug. 1966 147 p refs Presented at the 2d Intern. Congr. on Instrumentation in Aerospace Simulation Facilities, Stanford, Calif., 29–31 Aug. 1966
(Contract Nonr-839(38); ARPA Order 529; Proj. Defender)
(PIBAL-992; AD-639025) CFSTI: HC $4.00/MF $1.00

Electron number densities were measured behind the incident shock wave in a pressure driven shock tube by a microwave resonant cavity technique and by electrostatic probes. The driven gas was air at initial pressures of .5 and 1mm Hg, and the shock mach number was varied from 7 to 10. Electron neutral collision frequency was also determined by the microwave technique. The experimental measurements were compared with other measurements and with theory. Author (TAB)

N67-10312# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
PROGRESS IN THE STUDY OF HALL-CURRENT ACCELERATION Final Report, 1 Jun. 1965–31 May 1966
Raymond M. Measures 31 May 1966 29 p refs
(Grant AF-AFOSR-944-65)
(AFOSR-66-1858; AD-638677) CFSTI: HC $2.00/MF $0.50

The capacitor bank, necessary for the Hall current acceleration study, has been designed, developed and should shortly come into operation. The multi-cusp magnetic field configuration has been optimized to simulate as close as possible the model assumed in the theory of Haines for the Hall acceleration of a plasma. Experience has also been gained in the use of spectroscopical diagnostics of hot, dense plasmas. The electron number density and temperature, behind a strong shock wave, have been evaluated from a study of the H sub beta line Author (TAB)

N67-10361# Rydbeck Research Associates, Fjaras (Sweden).
COUPLED WAVE EQUATIONS FOR MULTI-MODE INHOMOGENEOUS MEDIA
O. E. H. Rydbeck and A. Hjalmarson Jun. 1966 87 p refs
(Contract AF 61(052)-864)
(AFCRL-66-607; SR-2; AD-637939) CFSTI: HC $3.00/MF $0.75

Wave propagation in multi (n-)- mode inhomogeneous media, quite generally is described by an n:th order wave equation with variable coefficients, or sometimes, especially in the case of 4-mode systems, by coupled, second order wave equations in total fields. It is shown how the propagation phenomena can be analyzed in terms of first order, coupled mode amplitude equations. These first order equations become especially simple when the system has symmetric, or anti-symmetric properties. Since the methods developed are completely general, they can be applied to a multitude of wave propagation phenomena, involving coupling between waves of very different physical nature Author (TAB)

N67-10467# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
AN EMPIRICAL FORMULA FOR THE ELECTRON IMPACT IONIZATION CROSS SECTION [EINE EMPIRISCHE FORMEL FUER DEN IONISIERUNGSQUERSCHNITT GEGENUEBER ELEKTRONENSTOSS]
Wolfgang Lotz Aug. 1966 27 p refs In GERMAN; ENGLISH summary
(IPP-1/50) CFSTI: HC $2.00/MF $0.50

An empirical formula with three free parameters is given for the representation of cross sections for single ionization of atoms and ions from the ground state by electron impact. Almost all experimental results can be approximated by this formula within 10% over the hole energy range between threshold and 10 keV; all experimental results can be approximated within experimental error. The formula proposed is not suitable to reproduce the exact contour of fine structures in the ionization cross section curve. Author

N67-10468# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).

EQUILIBRIUM AND STABILITY OF A PLASMA WITH SURFACE CURRENTS [GLEICHGEWICHT UND STABILITAET EINES PLASMAS MIT OBERFLAECHENSTROEMEN]

Horst Wobig Jul. 1966 54 p refs In GERMAN; ENGLISH summary

(IPP-6/53) CFSTI: HC $3.00/MF $0.50

In the following paper we investigate the equilibrium and the stability of toroidal plasma configurations characterized by a vanishing total azimutal current ($T_{az}=0$). Starting point is the model of a fieldless plasma with surface currents. From the equilibrium condition $B^2=8\pi p$ we obtain a differential equation for the surface S described by its distance $r(x^1,x^2)$ to a closed reference line. The stability is investigated using the energy principle of magnetohydrodynamics. It is shown, that the equilibrium surfaces calculated by Meyer and Schmidt are unstable against pure interchange perturbations ($\delta\vec{B}=0$). Furthermore a stability criterion for interchange disturbances is given. In the limit of a vanishing aspect ratio (linear bumpy ϑ-pinch) we also consider perturbations which change the magnetic field ($\delta\vec{B}\neq 0$). We obtain instability for perturbations with constant amplitude along the magnetic field lines. The growth rates are estimated. Author

N67-10477# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).

ON THE INTERNAL RESISTANCE OF MHD GENERATORS [ANALYTISCHE UNTERSUCHUNG DES INNENWIDERSTANDES VON MHD-GENERATOREN]

L L. Lengyel Jun. 1966 30 p refs In GERMAN; ENGLISH summary

(IPP-3/39) CFSTI: HC $2.00/MF $0.50

The internal resistance of MHD generators as a function of the electrode geometry and the Hall parameter is considered herein. The perturbation of the current and potential distributions by the Hall parameter and the effect of a staggered electrode geometry upon the internal resistance are studied in detail. It has been found that changes in the internal resistance for equal positive and negative staggering angles are identical. Author

N67-10494# Royal Inst. of Tech., Stockholm (Sweden). Microwave Dept.

PARAMETRIC COUPLING BETWEEN ION AND ELECTRON WAVES Scientific Report No. 6

A. Sjolund and L. Stenflo 31 May 1966 13 p ref

(Contract AF 61(052)-888)

(AFCRL-66-558; AD-637949) CFSTI: HC $1.00/MF $0.50

Parametric coupling between ion and electron waves are studied by means of coupled mode theory. The coupling coefficients are determined. A numerical example is given and the gain is calculated Author (TAB)

N67-10558# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany)

EXPERIMENTAL INVESTIGATIONS OF THE CURRENT DENSITY DISTRIBUTION IN A MAGNETOHYDRODYNAMIC GENERATOR WITH SEGMENTED ELECTRODES [EXPERIMENTELLE UNTERSUCHUNGEN DER STROM-DICHEVERTEILUNG IN EINEM MAGNETOHYDRODYNAMISCHEN GENERATOR MIT SEGMENTIERTEN ELEKTRODEN]

Fred W. Fischer Jul. 1966 50 p refs In GERMAN; ENGLISH summary

(IPP-3/41) CFSTI: HC $2.00/MF $0.50

In a magnetohydrodynamic generator with segmented electrodes the current distribution is inhomogeneous due to the existence of the Hall effect. This is particularly true in the immediate vicinity of the electrodes. Calculations of the current density distribution in a generator whose working fluid is a rare gas-alkali plasma were based on a theory with many simplifying assumptions. The results of these calculations were compared with measurements on an argon-potassium generator. Conclusions could be drawn on the distribution of electron temperature, and thus on current density, from the spatial intensity distribution of the potassium resonance lines. In general, qualitative agreement was found with the theoretically determined distribution. Near the electrodes, especially along the insulating wall between two electrodes, considerable differences from theoretical values were noticed. Measurements of the electrical potential along the insulating wall confirmed these latter observations. Author

N67-10560# Technische Hogeschool, Eindhoven (Netherlands).

INERTIAL EFFECTS IN THE DIFFUSION OF A PLASMA ACROSS A MAGNETIC FIELD

Richard Alan Gerwin (Ph.D. Thesis) 1966 189 p refs Supported by EURATOM, Boeing, and The Netherland Sci. Organ. CFSTI: HC $5.00/MF $1.00

We consider a column of ionized gas, infinitely long, immersed in a magnetic field parallel to the column axis. The diffusion of the plasma across the magnetic field is studied theoretically. Two cases are considered, namely, that of a time-independent magnetic field, and that in which the magnetic field has a time-dependent part. In the case of a steady magnetic field, the Bohm criterion for a sheath, previously invoked without much justification in some plasma diffusion problems, is derived under fairly general conditions, including cylindrical geometry, production and collisions of charged particles, and slightly and strongly ionized plasmas. In this derivation, it is essential to retain the usually neglected ion inertial terms in the ion momentum-balance equation. When the magnetic field has a part with a periodic time-dependence, it is shown that, under certain conditions, ion inertia rather than pressure gradients can cause the plasma to diffuse across the magnetic field towards the walls. The theory suggests that this diffusion mechanism, and also Ohmic heating, can become significant when the amplitude of the alternating magnetic field approaches the level of the steady magnetic field. Author

N67-10604# New York Univ., N. Y. Research Div.

THE USE OF ATOMIC BEAMS AS A PROBE FOR STUDYING LOW-DENSITY PLASMAS Final Report, Jun. 1959–Sep. 1965

B. Bederson and H. H. Brown 1 Mar. 1966 48 p refs

(Contract AT(30-1)-2397)

(NYO-2397-2) CFSTI: HC $2.00/MF $0.50

Various phases of an experimental program to investigate the use of neutral beams as a means of studying plasmas are reported. The theory of analysis of elastic scattering of neutral beams by plasmas is discussed, which includes effects due to neutral atoms, positive ions, and electrons. An analysis of the scattered beam profile is made for models based upon both single-scattering events (atom–ion) and multiple collisions (atom-electron). The experimental work described consists of a summary of the measurements of the attenuation of a potassium

beam by rare gases, as a function of the temperature of the scattering gas, similar studies for the attenuation of potassium and lithium by cesium and potassium neutral gases, and finally by essentially fully ionized cesium plasma. A description of the plasma chamber is included. Some auxiliary work on the design and performance of a fast neutral source is described. NSA

N67-10628# Vanderbilt Univ., Nashville, Tenn.
MAGNETIC FIELD TRANSPORT BY A SHOCK-PRODUCED PLASMA
Curtis Willard Parkin (M.S. Thesis) Jan. 1966 49 p refs
(Grant AF-AFOSR-287-64)
(TID-23144) CFSTI: HC $3.00/MF $0.50

An experiment is described in which trapping, transport, and decay of a magnetic field due to a transverse applied magnetic field-plasma flow interaction are observed. NSA

N67-10630# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
STABILITY OF A DENSE PLASMA CONFINED BY A ROTATING MAGNETIC FIELD
F. Troyon May 1966 73 p refs Submitted for Publication
(LRP-25/66)

The stability of a dense plasma (negligible skin depth) confined by a rotating magnetic field which is parallel to the surface is analyzed for plane and cylindrical geometries. This analysis culminates in an integro-differential equation for each mode of deformation. Specific properties of the plasma enter only through the normal acoustic impedance. The concept of average stability is introduced. Very general restrictions on the acoustic impedance of the plasma are introduced which allow the derivation of various stability criteria. These criteria are applied to different cases of interest. The plasma is described successively by fluid models of increasing complexity and a free particle model. Numerical estimates of the frequency needed to achieve stability for each mode are given. Author (NSA)

N67-10650# Sydney Univ. (Australia). Wills Plasma Physics Dept.
A STUDY OF THE MAGNETO-KERR AND OTHER EFFECTS AT A PLASMA SURFACE
L. C. Robinson Apr. 1966 39 p refs Sponsored by Australian Inst. of Nucl. Sci. and Eng.
(ER.21; NP-16160)

The role of microwave reflection observations and particularly the magneto-microwave Kerr effect in the study of plasma surface phenomena is discussed. The method makes possible the absolute measurement of high electron surface densities in a density region not readily accessible to other experimental techniques, and it gives an indication of the collision frequency for momentum transfer. To facilitate the interpretation of measurements in terms of plasma parameters, curves are computed for a step-function plasma profile giving the dependence of reflection on surface electron density and collision frequency over a wide range of magnetic induction fields and microwave frequencies. The results are directly applicable to the three microwave frequencies commonly used in plasma physics research, viz., 10 Gc/sec, 35 Gc/sec and 120 Gc/sec. From an analysis of the dependence of the magnitudes and phases of the reflection coefficients of circularly and linearly polarized incident waves the relative value of the various possible waves and combinations of waves for plasma diagnostic experiments is assessed. The effects of variations from a step-function plasma density profile are considered. Polynomial expressions are derived giving the factor by which the amplitudes and phases of the reflection coefficients are modified when the density rises exponentially to a plateau level; this factor is computed for steep gradients. Author (NSA)

N67-10674# Sydney Univ. (Australia). Wills Plasma Physics Dept.
CHARACTERISTICS OF LARGE-AMPLITUDE ALFVEN WAVES IN A LABORATORY PLASMA
I. G. Brown and C. N. Watson-Munro Mar. 1966 23 p refs Sponsored by Australian Res. Grants Comm., Australian Inst. of Nucl. Sci. and Eng., and Sydney Univ. Res. Comm.
(NP-16152; ER.19)

A study was made in a cylindrical hydrogenous laboratory plasma of a number of features of the propagation of Alfven waves whose wave magnetic field b_0 is not small compared to the static field B_0. With perturbation ratio b_0/B_0 increasing to values as high as 1.3, the steepening of the initial sine wave into a shock front was studied, the local wave velocity was measured and found to be consistent with a velocity predicted from shock theory, the increase of hydromagnetic impedance was examined, and the change in ionized particle density following the passage of the wave was studied spectroscopically. Author (NSA)

N67-10721# Laboratoire de Recherches sur la Physique des Plasmas, Lausanne (Switzerland).
HIGH FREQUENCY ROTATING MAGNETIC FIELD [CHAMP MAGNETIQUE TOURNANT À HAUTE FREQUENCE]
A. Lietti Jun. 1966 15 p refs In FRENCH; ENGLISH summary
(LRP-26/66)

A device is described which produces a rotating field on the surface of a cylindrical hydrogen plasma column of 5 cm diameter and 44 cm length. The highest amplitude obtained is 1.8 kG at a frequency of 2.17 Mc. Author (NSA)

N67-10725# Stanford Univ., Calif. Inst. for Plasma Research.
STUDIES OF PLASMA OSCILLATIONS Quarterly Status Report, 1 Mar.–31 May 1966
F. W. Crawford Jun. 1966 29 p refs
(Contract AT(04-3)-326)
(SU-IPR-76; QSR-26) CFSTI: HC $2.00/MF $0.50

Theoretical and experimental work on the positive column in a magnetic field has continued. Specifically, the steady-state theory, and low-frequency perturbations of it, leading to wave propagation and instabilities, were studied. Electric field measurements in plasma by electron beam probing are reported. Computations of dispersion characteristics of electron beam-plasma interactions are presented. NSA

N67-10780# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
OSCILLATIONS OF CONFINED (CYLINDRICAL) PLASMA WITH A HOT ELECTRON CURRENT [O KOLEBANIYAKH OGRANICHENNOI (TSILINDRICHES-KOI) PLAZMY S GORYACHIM ELEKTRONNYM TOKOM]
V. G. Makhan'kov 1966 10 p refs In RUSSIAN
(JINR-P-2783-2)

A dispersion equation is obtained for a confined cylindrical plasma with a hot current in the case in which the Debye electron expansion is larger than the transverse dimensions of the system. The excitation and increment of various oscillation modes are analyzed assuming the presence of mirror reflections. Author (NSA)

N67-10814# United Kingdom Atomic Energy Authority, Culham (England). Research Group.
CONFERENCES ON PLASMA PHYSICS AND NUCLEAR FUSION RESEARCH
L. S. Francis, comp. Mar. 1966 28 p refs
(NP-16154)

A list is presented of 76 conferences and similar meetings of direct relevance to fusion research. The meetings were held during 1952 through 1965. NSA

N67-10820# California Univ., Berkeley.
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND PLASMAS, NO. 19
L. Brewer, comp. 30 Jun. 1966 16 p refs
(NP-16240)

Included is a list of 91 spectroscopy articles of interest in high temperature chemistry, and 51 articles on reactions between gases and condensed phases. NSA

N67-10839# Wisconsin Univ., Madison. Dept. of Physics.
EQUIPOTENTIAL SURFACES OF A PLASMA MOVING IN A TOROIDAL OCTUPOLE MAGNETIC FIELD
A. B. Filimonov, J. C. Sprott, D. E. Lencioni, and R. L. Willig [1966] 18 p refs Presented at the Am. Phys. Soc. Div. of Plasma Phys. Meeting, Minneaplolis, Jun. 1966
(Contract AT(11-1)-1233)
(COO-1233-32; CONF-660633-1) CFSTI: HC $1.00/MF $0.50

Measurements of the floating potential resulting from a 100-ev hydrogen plasma moving in a toroidal octupole magnetic field of a few kilogauss revealed a definite structure and time evolution of the equipotentials. It was found that in areas of relatively high density (10^{10} cm^{-3}), i.e., in the central region of the toroid, the magnetic field lines were equipotential surfaces. These surfaces (and consequently the $\vec{E}\times\vec{B}/B^2$ drift) agreed qualitatively with solutions found by J. W. Poukey for describing the drift in a uniform magnetic field, i.e., plasma separated into two sections which circulated in such a manner that the cloud propagated perpendicular to the magnetic field. Author (NSA)

N67-10854# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
PRODUCTION OF HOT-ELECTRON PLASMA IN MAGNETIC MIRROR TRAPS
B. S. Akshanov, Yu. Ya. Volkolupov, V. G. Marinin, K. D. Sinel'nikev, and A. M. Smirnov [1966] 41 p refs Transl. into ENGLISH from Russian Paper CN-21/249 Presented at the IAEA Conf. on Plasma Phys. and Controlled Fusion Res., Culham, England, 6–10 Sep. 1965
(AEC-TR-6782) CFSTI: HC $2.00/MF $0.50

The results are presented of an investigation of a plasma produced by the injection of an electron beam through a magnet system with opposed fields into a magnetic mirror trap. The efficiency of the production method is described. Various plasma properties are described in detail. NSA

N67-10894*# Illinois Univ., Urbana. Dept. of Electrical Engineering.
THE THEORETICAL AND EXPERIMENTAL DETERMINATION OF THE INPUT IMPEDANCE OF A SMALL LOOP OF ELECTRIC CURRENT IMMERSED IN AN ANISOTROPIC PLASMA
G. L. Duff and R. Mittra Oct. 1966 122 p
(Grant NsG-395)
(NASA-CR-79711; SR-8) CFSTI: HC $4.00/MF $0.75 CSCL 20H

The loop impedance is calculated by two methods of approximation for the case where the imposed steady magnetic field is normal to the plane of the loop. The first method uses the quasi-static approximation, for which a first order correction term is also calculated. The second approximate method involves the assumption that the medium is uniaxial. The loop impedance is also calculated under the uniaxial approximation for the case where the imposed steady magnetic field is parallel to the loop. A discussion of the experimental techniques in measuring the loop impedance is given. A brush-cathode discharge chamber was used. The theoretically derived impedance formulae are numerically evaluated for a wide range of the plasma parameters and the measured loop impedance is compared to the theory. There is good general agreement between the theoretical and measured loop impedance. Author

N67-10909# United Kingdom Atomic Energy Authority, Culham (England). Translations Office.
EXCITATION OF STRONG COLLISIONLESS SHOCK WAVES IN PLASMA
R. Kh. Kurtmullaev, V. K. Malinovskii, Yu. Ye. Nesterikhin, and A. G. Ponomarenko Jan. 1966 8 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (Moscow), no. 2, Mar.–Apr. 1965 p 79–83
(CTO/260; NP-TR-1378)

Experimental results were obtained on collisionless shock-wave excitation in a plasma. The plasma was created in a conical source by a pair of 17-μf, 10-kV capacitors. The discharge lasted 5 μsec at 350 kamps. The plasmoid was then accelerated through a 0–2 kgauss longitudinal magnetic field in a 5.2×200 cm glass tube. The shock-wave excitation was achieved by means of a copper coil supplied by a 0.6-μF, 50-kV capacitor bank. The discharge time was 10^{-6} μsec. The density of the plasmoid varied between 5×10^{14} to 5×10^{16} cm^{-3}. Spectrophotometric records indicated that after the excitation coil discharge, the plasma is set into periodic oscillations. The X-ray measurements on the plasmoid showed a sharp drop in X-ray output as the electron density of the plasma increased from 10^{14} to 10^{16}. These X-rays are shown to arise after the excitation of the plasma shock wave. Special collectors were used to measure the ion and electron currents, but it was not clear how the shock front was forming in the plasmoid. NSA

N67-10922# Stanford Univ., Calif. Inst. for Plasma Research.
A STATUS REVIEW OF MICROWAVE PLASMA DEVICE RESEARCH
F. W. Crawford Mar. 1966 41 p refs Presented at the IEEE San Francisco Sect., PGED Meeting, Stanford, Mar. 1966
(Contract DA-28-043-AMC-02041(E))
(SU-IPR-57; AD-639211) CFSTI: HC $2.00/MF $0.50

The paper discusses some of the obstacles to device development that have been encountered along the way, and some of the paths that are being taken to circumvent them. TAB

N67-10927# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
DISCONTINUITIES IN NON-IDEAL MAGNETOGASDYNAMICS Scientific Report No. 30
H. Friedel 27 Jun. 1966 18 p refs
(Contract AF 61(052)-675)
(AFOSR-66-1862; AD-639343) CFSTI: HC $1.00/MF $0.50

The well known evolutionary condition of ideal MGD is extended to non-ideal, one-dimensional MGD characterized by arbitrary dissipation terms. It is shown that in this case discontinuities may exist fulfilling the evolutionary condition. Concluding the case of a dissipation term due to finite electrical conductivity and its effect on contact discontinuities is investigated. These discontinuities are found to be non-evolutionary and therefore physically meaningless Author (TAB)

N67-10938# California Inst. of Tech., Pasadena.
A NONLINEAR STUDY OF BEAM PLASMA AMPLIFICATION
Robert L. Poeschel Sep. 1966 123 p refs
(Contract Nonr-220(50))
(TR-33; AD-639057) CFSTI: HC $4.00/MF $0.75

The interaction between an electron beam and the plasma oscillations it excites in traversing a plasma effectively changes the magnitude and direction of the force between beam electrons. The beam behavior is studied theoretically by computing in an exact, nonlinear manner, the trajectories of a disc model electron beam which traverses a linear, dielectric model plasma. The parameters varied are the beam space charge conditions (beam current), the degree of initial velocity modulation, and the ratio of modulation frequency to plasma frequency. Computations show that it is

possible to bunch the beam electrons to within 85% of delta function bunching under some beam and plasma conditions. The electron beam behavior is studied experimentally by observing the beam electron velocity phase distribution with a crossed-field velocity analyzer, and observing the beam current waveform (density-phase distribution) using a wide-band sampling oscilloscope. Experimental results show essentially the same beam behavior as predicted by the computations with some differences which are attributed to variation in the plasma density along the beam path
Author (TAB)

N67-10960# Mount Auburn Research Associates, Inc., Cambridge, Mass.
INVESTIGATION OF MAGNETOHYDRODYNAMIC WAVE PROPAGATION IN THE IONOSPHERE AND COLLISIONAL EFFECTS OF POSITIVE IONS WITH NEUTRAL PARTICLES Final Report, 6 Apr. 1965–14 Aug. 1966
Sheldon L. Kahalas, Walter E. Knabe, Brian L. Murphy, and Lee W. Parker 15 Aug. 1966 161 p refs
(Contract AF 19(628)-5133; ARPA Order 635)
(AD-637871) CFSTI: HC $5.00/MF $1.00

The propagation of magnetohydrodynamic waves above the E region of the ionosphere is treated with the aim of developing a computer program to predict the space-time history of magnetohydrodynamic waves generated by a given source. Changes in ionization density as a function of altitude and the geomagnetic field in the form of a magnetic dipole are incorporated. The Carovillano-McClay method of solution (expansion in vector spherical harmonics) was used. This leads to a set of coupled, second order, ordinary, differential equations to solve. Boundary conditions, for the case where the ionospheric plasma is treated as a cavity bounded by vacuum, are derived. Some preliminary numerical calculations, for a source consisting of an axisymmetric ring current located over the magnetic pole, are presented. The coupling of wave modes due to the Hall effect is discussed. The physics of positive ion-neutral particle collisions, important in the propagation of magnetohydrodynamic waves in the E region, has been considered from the point of view of possible modifications to the hydrodynamic equations. Corrections to the hydrodynamic moment equations due to space-time correlation effects have been investigated by the theory of Green and found to be small. Corrections to the adiabatic pressure relations due to the interaction of the positive ions with the neutrals is considered and found to be significant for the propagation of magnetohydrodynamic waves through the E layer. Various forms for the correction terms as they effect the momentum equations have been derived but no detailed calculations are carried out
Author (TAB)

N67-10963# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTEGRATING DIFFERENTIAL EQUATIONS OF A COLUMN OF AN ARC WITH ISOTHERMAL PLASMA WHICH IS COOLED BY MEANS OF HEAT CONDUCTIVITY
I. K. Fedchenko and O. S. Il'yenko 18 Apr. 1966 10 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. Rsr. (Kiev), no. 7, 1964 p 925–929
(FTD-TT-65-1767; TT-66-62314; AD-639334) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: integrating differential equations of a column of an arc with isothermal plasma which is cooled by means of heat conductivity.
TAB

N67-11010# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
A MAGNETOHYDRODYNAMIC FLOW IN THE SHOCK TUBE BOUNDARY LAYER WITH TRANSVERSE MAGNETIC FIELD
John K. Dukowicz Jul. 1966 107 p refs
(Grant AF-AFOSR-366-65)
(UTIAS-115; AD-639593) CFSTI: HC $4.00/MF $0.75

Some cases of boundary layer flow in a shock tube with insulated walls and a transverse magnetic field are investigated experimentally and theoretically. The configuration is similar to the insulator boundary layer in an MHD generator channel with a loading parameter equal to unity. With argon as the test gas, the experimental results show some cases where the heat flux to the wall is uninfluenced by the magnetic field, and others where a strong effect is observed. A Couette flow calculation, incorporating all relevant physical phenomena and representing the conditions encountered in the experiment, was carried out. The results indicate that the Hall effect has an important influence in such a way that when Hall currents are unrestricted there is little change in the heat flux. The strong interaction observed may be explained by the absence of Hall currents, or possibly by the occurrence of an electron thermal instability predicted by Kerrebrock at high Hall parameters. (Author)
TAB

N67-11070# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISPERSAL OF CONDUCTING GAS BY A RUNNING MAGNETIC FIELD
V. B. Baranov 21 Jun. 1966 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Mekhan. i Mashinostr. (Moscow), no. 4, 1960 p 14–18
(FTD-TT-65-1476; TT-63-12218; AD-639552) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: dispersal of conducting gas by a running magnetic field.
TAB

N67-11142# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING THE AVERAGE ELECTRON ENERGY LOSSES DURING THE DIFFUSION OF THE ELECTRON BEAM IN PLASMA
L. L. Pasichnyk 17 Jun. 1966 10 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 9, no. 9, 1964 p 1027–1030
(FTD-TT-65-1920; TT-66-62333; AD-639428) CFSTI: HC $1.00/MF $0.50

The experimental data given shows that at an abnormally strong reaction of the beam with plasma, the electrons of the beam lose up to 20% of their initial energy. A method for measuring this loss is described.
TAB

N67-11184# Stanford Univ., Calif. Inst. for Plasma Research.
BEAM/PLASMA INTERACTION WITH TRANSVERSE MODULATION
E. E. Abraham, F. W. Crawford, and D. M. Mills Aug. 1966 6 p refs Presented at 6th Intern. Conf. on Microwave and Optical Frequency Generation, Cambridge, England, Sep. 1966
(Contracts DA-28-043-AMC-02041(E); AT(04-3)-326)
(SUIPR-88; AD-639210) CFSTI: HC $1.00/MF $0.50

The paper presents computations for a finite beam in a finite plasma, indicating that the predicted growth rates for axisymmetric and transverse modulation are generally comparable, and describes some conclusive observations of growth in the transverse mode. Operation in this mode offers a possibility of overcoming the usual coupling difficulties of microwave beam/plasma amplifiers. A novel resonant coupling scheme being studied at Stanford is discussed
Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N67-10072# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE QUESTION OF THE ELECTRICAL ACTIVITY OF TIN IN GERMANIUM

A. P. Vinnikov and O. P. Balkashin [1966] 2 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Kiev), v. 11, no. 8, 1966 p 905–906 CFSTI: HC $1.00/MF $0.50

The Mossbauer effect was applied to observable resonance gamma quanta in an impurity nucleus to investigate electrical activity of an impurity in a semiconductor. Specifically examined was the resonance absorption of gamma quanta with 23.8 keV energy by admixtures of tin nuclei deep in germanium. The tin concentration was approximately 2 at. percent. Zone refined germanium and tin enriched with Sn^{119} isotope were fused in a water atmosphere, after which the alloys were hardened at a temperature of 900° C. The powder obtained after shrinking was deposited on aluminum foil. The absorption spectrum was recorded on an appratus with mechanical drive. Magnesium stannide was the source of resonance gamma quanta. Results suggest tin to be electrically active in germanium at a comparatively high concentration. K.W.

N67-10089# Royal Aircraft Establishment, Farnborough (England).
THE MOBILITY OF THE SURFACE ATOMS OF COPPER AND SILVER EVAPORATED DEPOSITS
Rosalie Brandon and F. J. Bradshaw Mar. 1966 38 p refs (RAE-TR-66095)

Estimates of the surface self-diffusion coefficients of evaporated deposits were made from (1) the spread of material into a shadow cast by the placing of an object between source and substrate, (2) the decay on annealing of the step produced in a metal film deposited onto a mica surface with a cleavage step, (3) the thermal grooving of grain boundaries in deposited films, and (4) the growth of holes in thin films. Rate laws were proposed and verified experimentally for step smoothing and the growth of holes. Author

N67-10123# Texas Instruments, Inc., Dallas.
THE EFFECT OF PHOSPHORUS DIFFUSION IN THERMAL OXIDES ON THE ELEVATED TEMPERATURE STABILITY OF MOS STRUCTURES
H. G. Carlson, G. A. Brown, C. R. Fuller, and J. Osborne *In* RADC Phys. of Failure in Electron., Vol. 4 Jun. 1966 p 390–407 refs (See N67-10101 01-34) CFSTI: HC $9.65/MF $2.75
(Contracts AF 30(602)-3723; AF 30(602)-3727)

Activation analysis is applied along with accurate sectioning techniques to the study of sodium distributions in simple dried steam oxides, of sodium and phosphorus distributions in phosphorus oxide diffused dried steam oxides, and of sodium and phosphorus distributions in more complex samples. Some data on thermal and electrical stressing of the capacitor structures formed in some of these manners is included for completeness. The stability findings agree with previous efforts. An empirical model for the contaminated planar oxide is discussed, and some qualitative arguments are offered for the cause of the various sodium distributions found in the study. R.N.A.

N67-10230*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF THERMAL TREATMENT ON THE PHOTOELECTRIC PROPERTIES OF SILICON HAVING STRUCTURAL MODIFICATIONS DUE TO RADIATION [ISSLEDOVANIYE VLIYANIYA TEMPERATURNOY OBRABOTKI NA FOTOELEKTRICHESKIYE SVOYSTVA KREMNIYA, SODERZHASHCHEGO RADIATSIONNYYE NARUSHENIYA STRUKTURY]
A. N. Sevchenko, V. D. Tkachev, P. F. Lugakov, and A. V. Yukhnevich Oct. 1966 6 p refs Transl. into ENGLISH from Dok. Akad. Nauk Belorussk. SSR, v. 10, no. 3, 1966 p 148–150 (NASA-TT-F-10378) CFSTI: HC $1.00/MF $0.50 CSCL 20L

The thermal stability of silicon monocrystals irradiated with high energy particles is investigated. A *p*-type silicon with a specific resistance of 7–100 ohm-cm and containing oxygen in a concentration of $3–8.10^{17}$ cm^{-3} was bombarded with 1 MeV electrons. Author

N67-10257# Tyco Labs., Inc., Waltham, Mass.
A UNIFIED APPROACH TO ENERGETICS RESEARCH, VOLUME I Final Report, Jun. 1963–Sep. 1965
A. J. Rosenberg, A. C. Makrides, and A. I. Mlavsky Dec. 1965 386 p refs
(Contract AF 19(628)-2845)
(AFCRL-66-134; Vol. I; AD-638362) CFSTI: HC $7.00/MF $1.75

Contents: Introduction: Electron-Phonon Interactions; Theory of acoustic-electron interactions in piezoelectric semiconductors; Electromechanical behavior of single crystal SrTiO3; Effect of invariance requirements on the elastic strain energy of crystals with application to the diamond type of crystal; Introduction: Photon-Phonon Interactions; Photon-phonon interactions in the near infrared; Higher order moments and multiphonon effects in non-metallic crystals; Dielectric constant in paraelectric perovskites; Infrared studies of perovskite titanates; Dielectric dispersion of some perovskite zirconates; Normal modes in hexagonal boron nitride; Introduction: Electron-Photon Phonon Interactions; Photovoltages at abrupt junctions between photoconductors and between photoconductor and semiconductor; Ultraviolet reflection spectrum of cubic CdS; Solar cells for high temperature use; Surface states and photovoltaic effect on silicon-metal interfaces; The origin of surface on silicon; The current dependence of injection luminescence; Photoeffects in organic conductors; Thin film crystal growth for large-area solar cells; Appendix to Volume I. TAB

N67-10258# Tyco Labs., Inc., Waltham, Mass.
A UNIFIED APPROACH TO ENERGETICS RESEARCH, VOLUME II Final Report, Jun. 1963–Sep. 1965
A. J. Rosenberg, A. C. Makrides, and A. I. Mlavsky Dec. 1965 305 p
(Contract AF 19(628)-2845)
(AFCRL-66-134; Vol. II; AD-638363) CFSTI: HC $7.00/MF $1.50

Contents: Introduction: Investigations on Silicon Carbide; The preparation of high purity silicon carbide; The growth of SiC single crystals from solution; The preparation of alpha-SiC P-N diodes; Electrical and optical properties of alpha-SiC P-N junction diodes; Introduction: Anodic processes; Fuel cell catalysts - nickel boride; Catalysts for hydrazine fuel cell anodes; Electrochemical oxidation of alkali borohydrides; Surface reactions of nickel and nickel boride electrodes; Introduction: Cathodic processes; The adsorption of oxygen by III-V compounds and germanium at 78K; Kinetic transitions in the oxidation of InSb, Ge, and Sb; The reduction of anodic oxide films on Au in HClO4 solutions with linear potential sweeps; Cobalt phthalocyanine as a fuel cell cathode; Introduction: Photobiological Studies; Interactions between daylength and light intensity in the growth and chlorophyll content of Acetabularia Crenulata; The endogenous regulation of the quantum yield of photosynthesis by circadian rhythms. TAB

N67-10301# Air Force Cambridge Research Labs., Bedford, Mass. Solid State Sciences Lab.
INDETERMINACY OF MOLECULAR FIELD COEFFICIENTS IN FERRIMAGNETS USING THE ANALYTICAL METHOD
Peter D. Gianino and Neil Grossbard May 1966 35 p refs *Its* Physical Sci. Res. Paper No. 232
(AFCRL-66-360; AD-638302) CFSTI: HC $2.00/MF $0.50

It was demonstrated that the analytical method proposed by Rado and Folen to calculate molecular field coefficients in ferrimagnets does not yield unique values of alpha and beta for YIG and lithium ferrite. Instead, only one of many possible pairs of (alpha, beta) values from a linearly related set are determined. The magnitudes of the internal magnetic fields, total magnetic moment and the two sublattice magnetic moments, computed from any one of these possible coefficients, remain relatively unchanged even though the (alpha, beta) and n are extremely sensitive both to input parameters and to the number of experimental data points utilized. From within the framework of the theory itself it is shown how it is possible for this manifold of (alpha, beta) pairs to exist, how they can be related in a linear manner, and how an analytic

expression for this dependency can be derived, utilizing low temperature information. A procedure for testing whether the coefficients for other ferrimagnets can be determined uniquely is discussed. Best values of (alpha, beta) are obtained by minimizing a least squares percentage error. These values not only fall along a straight line but are in good agreement with those generated in the usual application of the analytical method, thus further strengthening our contention. The possibility of using Rados linearity test as a criterion on which to judge the appropriateness of the selected value of the Curie point is shown to be invalid. Results for the various magnetic moments and internal fields under varying input conditions are given for both YIG and lithium ferrite
Author (TAB)

N67-10302# Rome Air Development Center, Griffiss AFB, N. Y.
HALL PROBE CHARACTERISTICS AT LIQUID NITROGEN TEMPERATURES Final Report
Joseph J. Chruscicki Jul. 1966 27 p refs
(RADC-TR-66-172; AD-638356) CFSTI: HC $2.00/MF $0.50

An experimental study was made to determine the effects of liquid nitrogen temperatures on the operating characteristics of some commercially available Hall effect devices to determine their potentialities for device application at 77K. The Hall probe behavior at liquid nitrogen temperatures is compared to the room temperature response. An increase in voltage sensitivity was noted. Probe operation with control currents exceeding the rated maximum is also described. (Author) TAB

N67-10304# Delaware Univ., Newark. Dept. of Physics.
GAS DESORPTION FROM VIRGINAL CdS CRYSTALS
K. W. Boer Jul. 1966 8 p refs
(Contract DA-31-124-ARO(D)-173)
(AROD-4461-14; TR-10; AD-638016) CFSTI: HC $1.00/MF $0.50

CdS single crystals are heated linearly in time while the desorption of gas is monitored continuously on a mass spectrometric located directly in front of the crystal. A desorption curve of CdS for amu 16 is given for a temperature range of -180C to +225C. Four sites (or layers) are seen to desorb with certain activation energies. Changes in surface structure are suggested since the process is not reproducible Author (TAB)

N67-10338# Delaware Univ., Newark. Physics Dept.
SURFACE PINNED LAYER-LIKE FIELD INHOMOGENEITIES IN CdS Technical Report No. 11
K. W. Boer Jul. 1966 10 p refs
(Contract DA-31-124-ARO(D)-173)
(AROD-4461-12; AD-637856) CFSTI: HC $1.00/MF $0.50

In a CdS platelet a slow-moving high electric field domain which changes in width appreciably in time was observed using the Franz-Keldysh effect. Photographs and a current-versus-time curve are presented, which show that the changing high field domain is actually the projection of a narrow high field layer spread in the bulk of the crystal, whose edges move at the crystal surfaces with different velocities Author (TAB)

N67-10357# Illinois Univ., Urbana. Materials Research Lab.
SUPPLEMENT TO MAY 1965 REPORT ON MATERIALS SCIENCES RESEARCH Annual Technical Report, 1 Oct. 1964–30 Sep. 1965
1 Nov. 1965 97 p refs
(Contract ARPA SD-131)
(AD-632316) CFSTI: HC $3.00/MF $0.75

Brief summaries are given of research progress and results on ARPA and AEC supported research at the UI Materials Research Laboratories in the areas of cryogenics, crystallography, spectroscopy, metal physics, superconductivity, semi-conductors, solid state physics and electronics, phase studies, high-pressure research, radiation damage and related topics. TAB

N67-10358# Massachusetts Inst. of Tech., Cambridge. National Magnet Lab.
[MAGNET RESEARCH AND DEVELOPMENT, SOLID STATE RESEARCH PROGRAMS, AND COOPERATIVE PROGRAMS] Quarterly Technical Status Report, 1 Oct.–31 Dec. 1965
31 Dec. 1965 37 p refs
(Contract AF 49(638)-1468)
(AFOSR-66-0273; AD-638343) CFSTI: HC $2.00/MF $0.50

Contents: Water-cooled Magnets, Heat Transfer Studies, Superconducting Magnet Studies, Shift of Landau Levels in Crossed Electric and Magnetic Fields, Linewidth in Crossed Electric and Magnetic Fields, Dynamics of Bloch Electron in Crossed Electric and Magnetic Fields, Magnetoabsorption in GaAs, Magnetoabsorption in In Sb and InAs, Far Infrared Cyclotron Resonance, Magneto-optical Transitions with Optical Phonons, Theory of Semiconductor Lasers in a Magnetic Field, Periodic Size Effect in Gallium, High Field Magnetic Susceptibility Measurements, Improved Sensitivity of the 35 GHz Varian Spectrometer, Cyclotron Resonance in Graphite, Mossbauer Effect, A. C. Susceptibility Measurements Employing Oscillating Temperatures, Higher Order Correlations in Superconductors, Adiabatic Demagnetization Program, Type II Superconductors, Dissipation in Type II Superconductors, L-C Resonance in a Superconducting Loop with One Josephson Junction, Bulk Radiative Properties of Superconductors, Elementary Particles, Electrical Resistance Due to Nonmagnetic Localized State in Dilute Alloys, Contribution of Core Polarization to Hyperfine Fields of 4d Ions, Fermi Surface, Magnetic Ordering and Electrical Properties of Rare-earth Metals, Investigation of Dipolar Fields in Ferromagnets, Tunneling and Magnetoresistance in Semiconductors, High Field Magnetostriction Studies, Measurement of the Transverse Magnetostriction Studies, Measurement of the Transverse Magnetoresistance of Sodium and Potassium. TAB

N67-10365# Army Electronics Lab., Fort Monmouth, N. J.
ULTRA-LOW-NOISE TRAVELING-WAVE TUBES
Bruno Zotter Aug. 1966 16 p refs
(ECOM-2737; AD-638447) CFSTI: HC $1.00/MF $0.50

The influence of high magnetic fields in the gun region on the noise figure of traveling-wave tubes was investigated experimentally and analytically. The experiments were performed with a superconducting magnet capable of fields up to 30,000 gauss. Noise reduction of over 2 db was measured. The analytical work resulted in a model which attributes the dependence of noise figure on magnetic fields to the coupling of axially symmetric space charge and transverse modes. Enhancement of the coupling mechanism is predicted for annular beams and for beams in magnetic field gradients Author (TAB)

N67-10373# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
DE-HAAS VAN ALPHEN OSCILLATIONS IN THE CRITICAL TEMPERATURE OF TYPE-II SEMICONDUCTORS
Leon Gunther (Tufts Univ.) and Leonard W. Gruenberg 8 Aug. 1966 10 p refs
(Contract Nonr-3963(16))
(TR-3; AD-637824) CFSTI: HC $1.00/MF $0.50

The report shows that the critical temperature T sub c(H) of a type-II superconductor exhibits dHvA oscillations with the usual period mu/omega sub c, where mu is the Fermi energy and omega sub c = eH/mc is the cyclotron frequency. The result includes electron spin and is valid even outside the Ginzburg-Landau region. It demonstrates the feasibility of observing the effect at low temperatures through the oscillations of the resistivity in the transition region Author (TAB)

N67-10407# Delaware Univ., Newark. Physics Dept.
STATIONARY FIELD INHOMOGENEITIES IN HOMOGENEOUS SEMICONDUCTORS DUE TO NEGATIVE DIFFERENTIAL CONDUCTIVITY Technical Report No. 12

Philip Lawrence Quinn (M.S. Thesis) Jun. 1966 64 p refs
(Contract DA-31-124-ARO(D)-173)
(AROD-4461-11; AD-637821) CFSTI: HC $3.00/MF $0.75

Layer-like field inhomogeneities in homogeneous semiconductors, which have been shown to occur whenever the conductivity decreases faster than linearly with increasing field, are discussed using a reaction-kinetic model including the Poisson and transport equations. Stationary solutions when the negative differential conductivity is either due to field-dependent carrier concentration or to field-dependent mobility are obtained in the approximation that the diffusion term is negligible compared to the drift term in the transport equation. When diffusion is included, an analysis by the method of characteristics, previously applied to the case of field-dependent carrier concentration, is extended to the case of field-dependent mobility. In the appendices the results of this discussion are compared with those of discussions by Ridley and by Bonch-Bruevich and Kalashnikov Author (TAB)

N67-10419# Westinghouse Electric Corp., Elmira, N. Y. Electronic Tube Div.
SOLID STATE IMAGE INTENSIFIERS
D. C. Fowlis, M. A. Novice, and Z. Szepesi Jun. 1966 9 p
(Contract N61339-66-C-0064)
(AD-638217) CFSTI: HC $1.00/MF $0.50

Different deposition methods were experimentally tried for improving the compactness of the CdSe PC layer and thereby eliminate the grainy appearance of the optical image on the intensifier panel. For the same purpose the tin-oxide electrode was substituted by a Cr-SiO film. The latter experiment resulted in an improved picture. Both semi-transparent and opaque black films were prepared with characteristics approaching the required values. However the semi-transparent layer deposited on the El layer was inferior to that deposited on a glass plate. Spectral emission curves of several sample EL and PL (photo-luminescent) phosphors were recorded and CIE chromaticity coordinated calculated. A standard green EL phosphor mixed with a red PL phosphor produced a color approximating a 3200K color temperature tungsten lamp Author (TAB)

N67-10450# National Bureau of Standards, Boulder, Colo. Radio Standards Lab.
SIGNIFICANCE OF A DIMENSIONALITY IN THE SPIN WAVE THEORY OF FERROMAGNETISM
Henry Unruh, Jr. 19 Apr. 1966 14 p refs
(NBS-TN-327) GPO: $0.20

The significance of dimensionality in the magnetic properties of a single domain ferromagnetic system is determined utilizing a new approach to the spin wave theory and a few plausible assumptions. If conditions are such as to produce spontaneous magnetization in a finite temperature range for a specific dimensionality then under the same conditions there exists a finite temperature range for every dimensionality in which spontaneous magnetization occurs. Author

N67-10492# Louisiana State Univ., Baton Rouge.
TRANSPORT EFFECTS IN SOLIDS Final Report, Feb. 1, 1963–Jul. 31, 1966
J. M. Reynolds [1966] 11 p refs
(Grant DA-ARO(D)-31-124-G423)
(AD-637829) CFSTI: HC $1.00/MF $0.50

Principal efforts of the research program were directed to the establishment of rf resonance methods to yield band theory parameters. Experiments were established in nuclear magnetic resonance, magneto-acoustic resonance, cyclotron resonance, electron spin resonance, and radio frequency size effects, all in metals. Significant results were obtained in almost all of the areas. Some of the most salient results are given Author (TAB)

N67-10497# Melpar, Inc., Falls Church, Va.
RESEARCH ON ANISOTROPY IN POLYCRYSTALLINE DIELECTRIC MATERIALS Final Report
Donald H. Rice and Richard W. Stowe Jun. 1966 93 p ref
(Contract NOw-65-0440-d)
(Rept.-5248.00100; AD-638450) CFSTI: HC $3.00/MF $0.75

This report covers the continuation of studies of dielectric anisotropy found in polycrystalline ceramic bodies. During this program, some of the mechanisms contributing to dielectric anisotropy were investigated. Specifically, these were: (1) preferred orientation of component crystals, (2) residual stresses in the crystal lattice, and (3) density gradients in the materials. X-ray diffraction techniques were used to characterize the materials in terms of preferred orientation and internal stress and these characteristics were correlated with the dielectric properties of those materials in order to evaluate the contributory effects of those characteristics to dielectric anisotropy. It was shown that preferred orientation was the major factor in dielectric anisotropy observed in ceramic bodies Author (TAB)

N67-10600# California Univ., Berkeley. Inst. of Engineering Research.
TRANSPARENT GOLD FILMS ON NONMETALLIC SURFACES
D. W. Fuerstenau, T. W. Healy, and C. R. Guerra 1 Jan. 1966 165 p refs
(MT-66-1)

The nature and properties were examined of thin metal, particularly gold, films on oxide substrates. Infrared spectra correlations are obtained for silica powder covered with metals and treated with ionic solutions, and relationships are developed between the adhesion and spreading of the film forming metal. To establish these relationships, spectral, electrical, and mechanical properties of films and substrates were determined for a variety of systems, preparation, and treatments of the film and substrate. The investigation has shown that gold films on glass are discontinuous at a thickness less than 100 A, with poor reflectivity and conductivity. Among other metals than gold, films of Cu, Cr, and Ni showed the best continuity on glass. The annealing of gold films on glass produced extensive growth of metal "islands", and the deposition of reactive metals on silica powder produced variations of the intensity and symmetry of infrared bands. A.G.O.

N67-10605# Franklin Inst., Philadelphia, Pa. Research Labs.
X-RAY INVESTIGATIONS ON THE STRUCTURE OF EVAPORATED FILMS Final Technical Report
Fred Witt Jun. 1966 57 p refs
(Contract AT(30-1)-3347)
(F-B2196; NYO-3347-1) CFSTI: HC $3.00/MF $0.50

In situ X-ray investigations were carried out on evaporated metal films in a high vacuum X-ray diffractometer attachment. Copper, silver, and gold films were deposited in vacua between 10^{-7} and 10^{-9} torr on glass and silver was also deposited on a CaF_2 substrate at 80° K. The X-ray measurements were made on the as-deposited films and after various annealing treatments. Information was obtained from the as-deposited films on the intrinsic stacking fault density, twin fault density, uniform and nonuniform strain, crystallite size, and texture. Annealing to various temperatures (up to 350°C) produced considerable grain growth and texture changes, which are qualitatively explained in terms of surface energies and thermal strain energies. Author (NSA)

N67-10681# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
COHERENT BREMSSTRAHLUNG AND PAIR PRODUCTION IN THE DIAMOND CRYSTAL IN GRAPHICAL REPRESENTATION BETWEEN 1 AND 40 GeV
G. Lutz and U. Timm May 1966 36 p refs
(DESY-66/15)

Numerical information on coherent effects of bremsstrahlung and electron pair production in diamond crystals in the energy range from 1 to 40 Bev is presented. The information is collected in a number of graphs and tables showing the intensity and polarization of bremsstrahlung and the cross section and asymmetry ratio for pair production as a function of crystal orientation. The basic formulas for the interpretation of the diagrams are given. The experimental problem of a precise orientation of the crystal, which is closely connected with the production of coherent radiation, is discussed on the basis of these formulas. Author (NSA)

N67-10706# Stanford Univ., Calif. Stanford Linear Accelerator Center.

A HIGH-FIELD 1.3M SUPERCONDUCTING SPLIT COIL MAGNET WITH FORCED LIQUID HELIUM COOLING

H. Brechna Apr. 1966 36 p refs Presented at the Swiss Elec. Eng. Soc. Superconductivity Conf., Zurich 17–18 May 1966

(Contract AT(04-3)-400)

(SLAC-PUB-182; CONF-660544-1) CFSTI: HC $2.00/MF $0.50

Experiments are described with various superconducting type II cables and hollow conductor configurations, current distribution, size effect in superconductor and performance of multistranded superconducting stabilized cables and magnets. A 30 cm bore 70 kG split coil magnet with a total field energy of about 6×10^6 joules is presented and a new superconducing coil configuration with forced liquid helium cooling introduced, which will produce about 55 kG in the center of the SLAC 1m liquid helium bubble chamber. Author (NSA)

N67-10737# Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany). Zentralinstitut fuer Kernforschung.

DEVELOPMENT OF STANDING-NEUTRON WAVES THROUGH INTERFERENCE IN NEARLY PERFECT SINGLE CRYSTALS AND THEIR INFLUENCE ON THE INTERACTION OF NEUTRONS WITH NUCLEI [BILDUNG STEHENDER NEUTRONENWELLEN DURCH INTERFERENZ IN NAHEZU IDEALEN EINKRISTALLENA UND IHR EINFLUSS AUF DIE WECHSELWIRKUNG DER NEUTRONEN MIT DEN ATOMKERNEN]

Dieter Sippel Oct. 1965 50 p refs In GERMAN

(ZFK-RN-32)

The interference phenomena of thermal neutrons were studied with respect to the effect of the abnormal absorption in the passage of neutrons through the crystal with the detection of the standing wave fields in the crystal and the quenching solution effect arising through surging phenomena in the interference of two wave fields with various large wave vectors in the center of the crystal. The conditions that must be fulfilled in order to use the dynamic theory of X-ray interference in crystals for thermal neutrons are given. Formulas of a dynamic interference theory for neutrons without consequent consideration of the incoherent scattering were derived. By double-crystal experiments with InSb crystals, the effect of the abnormal was reduced and increased absorption was observed. Therefore, the standing wave field of thermal neutrons in the crystal could be detected. It was shown that the atomic nuclei with positive scattering amplitude can scatter simultaneously thermal neutrons in interference in the ideal crystals. The deviations of the measurement curves from the calculated curves can be explained by faults of the crystal lattice. The sensitivity of the effects to the lattice defects was established. The interference of both wave fields can be detected by observation of the quenching solution of thermal neutrons. NSA

N67-10835# Sandia Corp., Albuquerque, N. Mex.

TRANSIENT ANNEALING IN SEMICONDUCTOR DEVICES FOLLOWING PULSED NEUTRON IRRADIATION

H. H. Sander and B. L. Gregory [1966] 32 p refs Presented at the Ann. IEEE Conf., Palo Alto, Calif. Supersedes< SC-DC-66-1443<

(Contract AT(29-1)-789)

(SC-DC-66-1820; SC-DC-66-1443; CONF-660705-1) CFSTI: HC $2.00/MF $0.50

Transient annealing following pulsed neutron exposure was investigated in silicon transistors and solar cells as a function of both irradiation temperature and injection level. In addition, experiments incorporating both x and gamma irradiation have demonstrated that transient annealing is a bulk, not a surface, effect. The observed annealing following neutron irradiation is considerably slower at low temperatures than at room temperature. At 213°K the density of annealable defects remaining at 10^{-4} seconds after exposure is approximately three times that observed at this same time for a 300°K irradiation. The injection studies show that at any temperature from 76 to 300°K the presence of minority carrier injection considerably speeds the transient annealing processes. A model is presented which explains many of the features observed in transient annealing. Various kinetic processes are discussed in the derivation of this model, including diffusion limited and generated limited processes, and the results of the model are compared to experimental data. Author (NSA)

N67-10874*# Southern Methodist Univ., Dallas, Tex.

BASIC RESEARCH IN SEMICONDUCTOR DETECTOR-DOSIMETER CHARACTERISTICS, AS APPLIED TO THE PROBLEMS OF WHOLE BODY DOSIMETRY Annual Progress Report

George W. Crawford Sep. 1966 82 p refs

(Grant NsG-708)

(NASA-CR-79718) CFSTI: HC $3.00/MF $0.75 CSCL 20L

The preparation of lithium-drifted semiconductor nuclear particle detectors is discussed in detail. The associated theory is reviewed, including basic material, diffusion, p–n junctions, drift, and operation, and the preparation and experimental results of the detector are presented. It was concluded that preparation and use of the detector are both feasible and desirable. It was pointed out that excellent agreement can be obtained between experimental and theoretical determinations of stopping power, average excitation energy, and electron hole pair formation energy for silicon. Summary reports are also included on other phases of basic research in semiconductor detector–dosimeter characteristics, including charge–pulse response of silicon detectors, detector lifetime behavior studies, stopping power measurements, and correlation between biological response and dose measurement. L.E.W.

N67-10890*# Stanford Univ., Calif. Electronics Lab.

PHOTOEMISSION STUDY OF THE ELECTRONIC STRUCTURE OF CdTe

J. L. Shay and W. E. Spicer [1966] 14 p refs

(Grant NGR-05-020-066)

(NASA-CR-79706) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Band structure assignments of optical structure in CdTe were determined in a detailed photoemission study. The experiments were performed on single crystals cleaved in a high vacuum chamber at a pressure of 10^{-9} Torr, and in a low vacuum chamber at a pressure of 10^{-4} Torr. Measurements were made for $5.4 \leq h\nu \leq 21.2$ eV. Data on the correlation of optical and photoemission structure is tabulated, and energy distributions are graphed. The results show that the assignment of optical structure on the basis of extrapolation from Group IV elements is very unreliable. N.E.N.

N67-10891*# Kansas Univ., Lawrence.

INVESTIGATION OF ELECTROCALORIC EFFECTS IN FERROELECTRIC SUBSTANCES Status Report No. 5, 1 Mar.–31 Aug. 1966

31 Aug. 1966 29 p refs

(Grant NsG-575)

(NASA-CR-79708) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Studies of the electrocaloric effect in single crystals of potassium dihydrogen arsenate (KDA) were made throughout the temperature range over which the effect is appreciable, from 90.45°K to 100.57°K, which included the ferroelectric transition temperature. The dielectric and electrocaloric behavior of KDA is similar to that of KDP. The first Devonshire coefficient ω is not a smooth function of T through the transition region, and no analytical expression for the elastic Gibbs function G_1 was found that would describe the crystal both above and below the Curie temperature. The slow part of the change in polarization that accompanied each step-wise change in applied field was similar to but smaller than those observed with KDP. Both the static dielectric measurements and the electrocaloric measurements taken in the nearly-reversible tails of the hysteresis loops gave evidence for believing that the ferroelelectric transition in KDA is of first-order rather than second-order. Cooling curves taken of the single-crystal, short-circuited specimen supported this belief and were at variance with specific heat measurements reported for polycrystalline, open-circuited specimens. Author

N67-10903# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

STUDY OF SUPERCONDUCTORS IN THE ALUMINUM-MAGNESIUM SYSTEM [ETUDE DES SUPRACONDUCTEURS DU SYSTEME ALUMINUM-MAGNESIUM]

Bernard Bonnin (Ph.D. Thesis—Grenoble Univ.) 1966 95 p refs In FRENCH
(CEA-R-2906)

An apparatus for the measurement of the magnetization of superconducting alloys by the classical method of extraction was designed and built. Its originality is due to the employment of a cryostat having two helium baths. The lowest temperature reached by pumping on the inner-most helium bath using a primary pump combined with a Booster pump was 0.75°K. Temperatures were determined with an aid of Hartshorn bridge. With this apparatus, it was possible to study the influence of extended defects on the irreversible behavior of the magnetization of aluminum–magnesium alloys. It was shown that the effect of these defects is important chiefly in the super-conductor alloys of the second kind. Author (NSA)

N67-10918# Western Reserve Univ., Cleveland, Ohio. Dept. of Physics.

STUDY OF THE ELECTRON MOMENTUM DISTRIBUTION IN SILICON AND GERMANIUM BY POSITRON ANNIHILATION

James C. Erskine, Jr. (Ph. D. Thesis) Jun. 1966 68 p refs
(Contract AT(11-1)-1297
(COO-1297-7) CFSTI: HC $3.00/MF $0.75

A study is presented on the angular distribution of the two-photon annihilation radiation in order to provide information about the momentum distribution of electrons in solids which can participate in the annihilation process. The study was confined to solids in which positronium is not formed. The study was performed on the well known semiconductors silicon and germanium. NSA

N67-10930# Bristol Univ. (England). H. H. Wills Physics Lab.

AN INVESTIGATION OF CRYSTAL IMPERFECTIONS BY X-RAY DIFFRACTION Final Report

A. R. Lang 20 Apr. 1966 134 p refs
(Contract AF 61(052)-449)
(ARL-66-0118; AD-638530) CFSTI: HC $4.00/MF $1.00

High resolution X-ray topographic methods have been used to study lattice imperfections in many natural and man-made crystals. Individual lattice imperfections can be resolved in specimen thicknesses from a few microns to several millimeters. The topographic resolution obtainable is one micron. The effects on the resolution of X-ray geometry, mechanisms of diffraction contrast, photographic processes and statistical fluctuations are discussed. Lattice imperfections studied include dislocations, inclusions, precipitates, impurity layers, and fault surfaces such as stacking faults and twin boundaries. Both the direction and sense of dislocation Burgers vectors can be determined. Studies performed on natural diamond include the origin of dislocations and the correlation of dislocation outcrops with trigon pits; the correlation of lattice imperfections, ultra-violet absorption and spike reflections in Type I and Type II diamonds; planar defects of stacking-fault type; abrasion of natural and polished faces; and the structure of coated diamonds. Synthetic diamonds have been studied by diffraction topography and microradiography. Configurations of grown-in dislocations and of dislocations deliberately introduced by plastic deformation have been studied in silicon, germanium and indium antimonide. The configuration and origin of dislocations have also been investigated in LiF, MgO, aluminium, Al_2O_3, quartz and some organic crystals Author (TAB)

N67-10967# Ohio State Univ. Research Foundation, Columbus.

PROPERTIES OF SOLIDS AT LOW TEMPERATURES, PHASE I Final Report

J. G. Daunt Dec. 1965 5 p refs
(Contract Nonr-495(20))
(AD-624824) CFSTI: HC $1.00/MF $0.50

A bibliography of technical reports, articles, and papers on the subject of properties of solids at low temperatures is presented. L.E.W.

N67-10978# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TEMPERATURE DEPENDENCE OF FREQUENCY AND EMISSION WIDTH OF THE R1 LINE OF RUBY

M. Ye. Movsesyan and Yu. S. Chilingaryan 25 Apr. 1966 8 p refs Transl. into ENGLISH from Akad. Nauk Armyansk SSR (Erevan), v. 39, no. 4, 1964 p 217–219
(FTD-TT-65-2006; TT-66-62240; AD-638901)

The conditions for induced radiation are most easily fulfilled for the maximum line of luminescence, and consequently there should be complete coincidence of the dependences on the temperature of the displacement on the maxima of the line of luminescence and the induced emission. In this work there was investigated the shift of the maximum of the line of fluorescence of Ruby R1 as depends on the temperature, and this change was compared with the temperature change of the maximum of induced emission. TAB

N67-11000# Stanford Research Inst., Menlo Park, Calif.

GROWTH AND CHARACTERIZATION OF β-SILICON CARBIDE SINGLE CRYSTALS Scientific Report, Oct. 1965–May 1966

W. E. Nelson, A. Rosengreen, R. W. Bartlett, F. A. Halden, and R. A. Mueller May 1966 75 p refs
(Contract AF 19(628)-4190)
(AFCRL-66-579; SR-3; AD-637942) CFSTI: HC $3.00/MF $0.75

Large single-crystal Beta-silicon carbide dendrites were grown in experiments in which convection stirring was reduced by crucible geometry and shielding. Addition of trace amounts of tantalum to the silicon melt improved the surface quality of crystals grown under conditions that normally favor the growth of coarse dendrites. Small untwinned single-crystal polyhedrons of Beta-silicon carbide were grown in melts stirred with a high velocity impeller. A theoretical treatment of silicon carbide solution growth was made in an attempt to more adequately define growth mechanisms and controlling parameters. Preliminary photovoltaic measurements indicate the absence of any large inhomogeneities in Beta-silicon carbide laths and plates. Hall measurements were made over the temperature range from 77-300K, and a high temperature furnace was constructed to extend measurements to high temperatures Author (TAB)

N67-11032# Brown Univ., Providence, R. I.
STUDY OF SURFACE PROPERTIES OF ATOMICALLY-CLEAN METALS AND SEMICONDUCTORS Final Report
H. E. Farnsworth, B. D. Campbell, and M. Onchi Ft. Monmouth, N. J., Army Electron. Command, Jun. 1966 58 p refs
(Contract DA-28-043-AMC-00299(E))
(Rept.-9; ECOM-00299-F; AD-639345) CFSTI: HC $3.00/MF $0.50

Activation energies were measured for the adsorption and desorption of oxygen on cadmium sulfide surfaces. On the basis of these and other results it is suggested that there are two types of oxygen adsorption. One type produces charged surface states, the other leads to a dipole layer. Preliminary observations were made on a zinc oxide crystal. No photoenhanced uptake of oxygen was noted and no changes in surface photovoltage were obtained. Author (TAB)

N67-11044# Naval Scientific Technical Information Center, London (England).
ELECTRIC PROPERTIES OF GALLIUM ARSENIDE WITH ADMIXTURE OF GOLD
M. A. Krivov, E. V. Malisova, and G. S. Shishkov Jun. 1966 5 p refs Transl. into ENGLISH from Izv. Vysshikh. Uchebn. Zavedenii, Fiz. (Tomsk), no. 3, 1965 p 148–150
(NSTIC-TRANS-1769; NSTIC/06781/66; TT-66-62162; AD-638456) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: electric properties of gallium arsenide with admixture of gold. TAB

N67-11055# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 Feb.–30 Apr. 1966
18 Aug. 1966 72 p refs
(Contract AF 19(628)-5167)
(ESD-TR-66-207; AD-639064) CFSTI: HC $3.00/MF $0.75

Topics covered are Solid State Device Research, Optical Techniques and Devices, Materials Research, and Physics of Solids. TAB

N67-11057# Hewlett-Packard Co.,Palo Alto, Calif.
HOT ELECTRON EMITTER Final Scientific Report, 8 Dec. 1964–7 Dec. 1965
D. M. Chang Jul. 1966 99 p refs
(Contract AF 19(628)-4758)
(AFCRL-66-531; AD-639568) CFSTI: HC $3.00/MF $0.75

A review of the physics that underlies semiconductor-metal-semiconductor triode operation is presented. The topics treated are: metal-semiconductor Schottky barrier emitters and collectors, hot electron transport in metal films, and hot electron reflection at the collector barrier. A revised estimate of the maximum frequency of oscillation for the SMS triode is obtained and the high frequency capabilities of SMS triodes are compared with those of the bipolar transistor on a broader basis. Finally, the various attempts at fabricating an SMS triode at this Laboratory are described Author (TAB)

N67-11064# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF RARE EARTH IONS ON FERROMAGNETIC RESONANCE
Yu-Ping Ho and Xian-Zhen Meng 31 May 1966 45 p Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 20, no. 5, 1964 387–410
(FTD-TT-65-901; TT-65-64341; AD-638877) CFSTI: HC $2.00/MF $0.50

The ferromagnetic resonance of the tight exchange coupled system was discussed in the light of the correlation method (theory of Kubo). The resonance field, H sub o (or resonance frequency) and the line width 2 delta w of the ferromagnetic branch, and also that of the exchange, were determined from a general magnetic susceptibility tensor formula. Results indicate that so-called fast relaxation and slow relaxation are but two branches (the transverse and longitudinal) of the ferromagnetic resonance. (Author) TAB

N67-11101# Massachusetts Univ., Amherst. Polymer Research Inst.
A STUDY OF DYNAMIC OPTICAL PROPERTIES OF POLYMERIC SOLIDS Final Report, 1 Jul. 1963–30 Jun.1966
Richard S. Stein 23 Aug. 1966 4 p
(Grant DA-ARO(D)-31-124-G469)
(AROD-4051-13; AD-638760) CFSTI: HC $1.00/MF $0.50

Structural changes accompanying the deformation of crystalline polymers have been studied by the techniques of (a) birefringence, (b) light scattering, (c) X-ray diffraction, and (d) dichroism. These techniques have been utilized for both static and dynamic measurements. They have demonstrated that upon deforming a crystalline polymer, the initial response is a deformation of the superstructure, followed by a viscoelastic rearrangement of crystals within the deformed matrix. Dynamic mechanical behavior has been correlated with dynamic optical behavior in an effort to elucidate structural response mechanisms. Author

N67-11104# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
LASER RAMAN SCATTERING STUDIES OF CRYSTALS Annual Technical Report, 15 Jun. 1965–15 Jun. 1966
Herman Z. Cummins Jun. 1966 16 p refs
(Contract Nonr-4010(06) ARPA Order-306-63)
(AD-637256) CFSTI: HC $2.00/MF $0.50

Laser excited raman scattering has been explored as a technique for studying crystals containing impurities, particularly the rare-earth doped crystals widely used as laser materials. Spectra obtained with both and A(+)4880 A laser and a He-Ne 6328 A laser are given for CaF_2 and $CaWO_4$ crystals, both pure and doped with various rare earths. To date, the doped crystals studied have either produced strong fluorescence or else given spectra which are indistinguishable from those of the pure crystals. Modification of the instrumentation is discussed which is currently in progress. With the improved apparatus, further efforts are planned to look for electronic raman structure of the rare earth ions as well as modification of the vibrational raman structure due to perturbation of the lattice by the impurities. Author (TAB)

N67-11114# Honeywell, Inc., Hopkins, Minn. Research Center
ENERGY BAND STUDIES FROM THIN FILMS
H. H. Soonpaa Nov. 1965 30 p refs

Information that can be obtained from a crystal limited in one crystallographic direction to a few unit cells is presented. The *k*-values become discrete in that direction; and due to a limited choice of *k*-vectors in one dimension, a sharp change is observed from direct optical transitions to indirect optical transitions as the number of unit cells is increased. Good agreement between theory and experiment is observed in thin films of $Bi_8Te_7S_5$, a material which is very similar in structure to Bi_2Te_3. The films of $Bi_8Te_7S_5$ are prepared by cleavage from a large crystal, and in thickness they range down to one third of one unit cell (9.8173Å). Author

N67-11155# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PERIOD OF IDENTITY AND MICROHARDNESS OF SEMICONDUCTOR SOLID SOLUTIONS OF InP-GaAs
N. N. Sirota and L. A. Makovetskaya 21 Jun. 1966 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Belorussk. SSR (Minsk), v. 7, no. 4, 1963 p 230–232
(FTD-TT-65-2000; TT-66-67319; AD-639340) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: period of identity and microhardness of semiconductor solid solutions of inp-gaas. TAB

N67-11158# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETIC PROPERTIES OF POLYMERS CONTAINING FERROCENE
P. M. Belash, Ya. M. Paushkin et al 21 Jun. 1966 13 p refs Transl. into ENGLISH from Tr. Inst. Neftekhim. i Gaz. Prom. (Moscow), no. 51, 1964 p 48–53
(FTD-65-2043; TT-66-62365; AD-639575) CFSTI: HC $1.00/MF $0.50

Ferrocene was copolymerized with alpha-bromo-naphthalene and with n-dichlorobenzene, and the electron paramagnetic resonance and magnetic properties of the resulting substances were examined. Possible reasons for the observed ferromagnetism are discussed. TAB

N67-11181# Illinois Univ., Urbana. Dept. of Physics.
ISOMER SHIFT OF Fe^{57} IN TRANSITION METALS UNDER PRESSURE
R. Ingalls, H. G. Drickamer, and G. De Pasquali [1966] 20 p refs
(Contracts AT(11-1)-1198; Nonr-1834(05))
(COO-1198-389; AD-638006) CFSTI: HC $1.00/MF $0.50

Isomer shifts of Fe57 in several transition metals were measured as a function of pressure up to nearly 300 kbar. The host metals studied were V, Cr, Co, Ni, Nb, Mo, Pd, Ta, W, Pt, and Au. The data are discussed in terms of the volume dependence of (1) the density at the nucleus from 4s-like conduction electrons and (2) the density at the nucleus from 3s core electrons which are shielded by the 3d-like conduction electrons. Results of a previous paper regarding amount of 4s character, n-s, and amount of 3d character, n-d, in the iron impurity atom, are used. The data are shown to be consistent with: (1) n-s decreasing or n-d increasing, or both as one goes through each transition metal series toward more d electrons of the host and (2) n-s decreasing or n-d increasing, or both, as pressure is applied to the host metal. The degree of the effect (2) is shown to be related to the calibration constant of the isomer shift Author (TAB)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N67-10256# Army Aviation Material Labs., Fort Eustis, Va.
UTILIZATION OF AMMONIA AS AN ALTERNATE FUEL IN ARMY AIRCRAFT ENGINES
Nicholas C. Kailos Jun. 1966 66 p refs
(USAAVLABS-TR-66-52; AD-638360) CFSTI: HC $3.00/MF $0.75

An investigation was made to assess the feasibility of ammonia-fueled gas turbine engines in Army aircraft. In accordance with this objective, engine performance in the UH-1D helicopter and in the CV-7A fixed-wing aircraft was compared utilizing both hydrocarbon and anhydrous ammonia fuels. Aircraft fuel system requirements were investigated, and an elementary cost comparison was made for engine conversion kits and production engines. Engine maintenance was considered briefly. From this study, it is concluded that the use of ammonia as a gas turbine fuel results in considerably lower aircraft productivity than the productivity obtained from the use of hydrocarbon fuels Author (TAB)

N67-10279# Melpar, Inc., Falls Church, Va.
MECHANISM OF MICROBIOLOGICAL CONTAMINATION OF JET FUEL AND DEVELOPMENT OF TECHNIQUES FOR DETECTION OF MICROBIOLOGICAL CONTAMINATION Final Technical Report, 1 Mar. 1963–31 Jan. 1966
Gordon C. Blanchard Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Sep. 1966 212 p refs
(Contract AF 33(657)-9186)
(APL-TDR-64-70, Pt. III; Rept.-4019; AD-637876) CFSTI: HC $6.00/MF $1.25

The research was directed at developing rapid methods for detecting microorganisms in jet fuel water bottoms and at analyzing the chemical mechanisms by which microorganisms and other contaminants could cause operational difficulties in aircraft fuel systems. The mechanisms by which microorganisms produce emulsions, sludges, and fuel-soluble compounds and cause corrosion were studied. The ability of fuel isolates to produce emulsions was demonstrated, with jet fuel and pure hydrocarbons as substrates. The aldehyde and acid products of hydrocarbon oxidation, formed during the growth of the microorganisms, were believed to be responsible for some of the emulsions formed on jet fuel. Fuel oxidizing microorganisms were demonstrated to cause aluminum alloy corrosion by four different mechanisms: (1) alteration of the ionic composition of the growth medium, (2) production of corrosive compounds, (3) deposition on metal surfaces and establishing oxygen and metal concentration cells, and (4) production of electron mediators which transfer electrons from the metals to electron acceptors in the microorganisms. During the first year of study, the growth medium was found to contain corrosion inhibitors and corrosion stimulators. Microorganisms were demonstrated to cause corrosion by removal of nitrate and phosphate as inhibitors. Nitrate was then tested for its ability to inhibit corrosion.
(Author) TAB

N67-10368# IIT Research Inst., Chicago, Ill.
DETECTION OF WATER IN JET FUEL AND RESIDUAL FUEL. ITEM 2: PROTOTYPE INSTRUMENTATION Progress Report, 21 Jun.–21 Aug. 1966
Martin Salkowski 1 Sep. 1966 12 p
(Contract NObs-94353)
(IITRI-C6091-2-2; AD-638224) CFSTI: HC $1.00/MF $0.50

The objective of the program is to develop two instruments: one for detecting water in jet fuel and the other for detecting water in residual fuel. The basic technique being considered is infrared absorption at the 2.8-micron wavelength. At this point in the infrared spectrum, the extinction coefficient for the HOH structure is large. By utilizing the long wavelengths of light, the extinction coefficient for secondary contamination is small. This specificity will make the instrumentation accurate and reliable. Also, the measurements will be noncumulative as compared with techniques that the Navy utilizes today Author (TAB)

N67-10518# IIT Research Inst., Chicago, Ill. Technology Center.
DETECTION OF WATER IN JET FUEL AND RESIDUAL FUEL. ITEM I: BREAD INSTRUMENTATION Bimonthly Progress Report, Jun. 21–Aug. 21, 1966
Martin Salkowski 1 Sep. 1966 11 p
(Contract NObs-94353)
(IITRI-C6091-1-2; AD-638223) CFSTI: HC $1.00/MF $0.50

The objective of the program is to develop two instruments: one for detecting water in jet fuel and the other for detecting water in residual fuel. The basic technique being considered is infrared absorption at the 2.8-micron wavelength. At this point in the infrared spectrum, the extinction coefficient for the HOH structure is large. By utilizing the long wavelengths of light, the extinction coefficient for secondary contamination is small. This specificity will make the instrumentation accurate and reliable. Also, the measurements will be noncumulative as compared with techniques that the Navy utilizes today Author (TAB)

N67-10783*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF COAST-PHASE PROPELLANT MANAGEMENT SYSTEM FOR TWO-BURN ATLAS-CENTAUR FLIGHT AC-8
William A. Groesbeck Washington, NASA, Nov. 1966 21 p refs
(NASA-TM-X-1318) CFSTI: HC $1.00/MF $0.50 CSCL 21I

The propellant management of a full-scale cryogenic storage to support restart of main engines, following an extended low-gravity coast period, was successfully demonstrated for the first time on the Atlas-centaur flight AC-8. Vehicle configuration and propellant management techniques conceived for this mission were verified as control of the residual propellants was maintained throughout a 25-minute orbital coast. Disturbances induced in the liquid residuals were suppressed, residual liquid kinetic energies were dissipated, tank pressurization was stable, boiloff gases were vented overboard in a nonpropulsive mode, and the propellants were retained in a settled position to support restart of the main engines. Definition of the AC-8 propellant management configuration resulted from experience on the AD-4 flight, the first full-scale coast-phase experiment with low-gravity propellant management. This flight significantly revealed that model test results and scaling parameters did not properly account for the interaction between disturbing forces and energy levels peculiar to a full-scale configuration in a near earth orbit. The basic problems were those of controlling residual propellant motion and of discharging the boiloff gases overboard without upsetting the vehicle. The venting problem was corrected by redesigning the hydrogen vent system to inhibit liquid entrainment, to reduce impingement forces of vent gases against the vehicle, and to provide a more equal cancellation of the vent thrust forces. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N67-10207*# National Aeronautics and Space Administration, Washington, D. C.
PROSPECTS OF PISTON AND TURBOJET ENGINES FOR LIGHT AIRCRAFT [ZUKUNFT SAUSSICHTEN DER KOLBENMOTOREN UND TURBOTRIEBWERKE FUR LEICHTFLUGZEUGE]
L. v. Bonin and K. Grasmann Aug. 1966 57 p refs Transl. into ENGLISH of a Paper Presented at the 6th European Aeron. Congr., Munich, 1-4 Sep. 1965
(NASA-TT-F-10252) CFSTI: HC $2.50/MF $0.50 CSCL 21E

Analysis showing that a turbojet engine developed on the basis of a supercharging engine with very high bypass ratio should be superior to the piston and turbojet engines currently used in light aircraft. A discussion of the layout and rating of such an engine leads to a bypass configuration with a bypass ratio of roughly 6, capable of cruising at speeds between 500 and 550 km/hr with a payload comparable to that of equivalent piston engine aircraft. Author

N67-10221*# National Aeronautics and Space Administration, Washington, D. C.
BRIEF SUMMARIES OF PAPERS PRESENTED AT THE DGRR SYMPOSIUM ON ELECTRIC SPACE PROPULSION [KURZFASSUNGEN DER VORTRAEGE DES DGRR-SYMPOSIUMS ELEKTRISCHE RAUMANTRIEBE]
J. Surugue et al Oct. 1966 11 p refs Transl. into ENGLISH from GERMAN
(NASA-TT-F-10346) CFSTI: HC $1.00/MF $0.50 CSCL 21C

Summaries are presented on areas including the application of fluid magnetodynamics to space propulsion, state of development of the Giessen ion propulsion unit, colloid-particle electrostatic thrusters, diagnostic work concerning ion sources at the DFL, orbital test of an electric propulsion system, and the application of primary electric propulsion to space exploration. Author

N67-10222*# National Aeronautics and Space Administration, Washington, D. C.
SOME RESULTS RELATED TO SPACE PROPULSION [QUELQUES RESULTATS RELATIFS A LA PROPULSION SPATIALE]
Jean Surugue Oct. 1966 31 p refs Transl. into ENGLISH from O.N.E.R.A. Paper T. P.-328 Presented at the D.G.R.R. Symp. on Elec. Propulsion, Sonnenberg, 24 Feb. 1966 p 1-10
(NASA-TT-F-10347) CFSTI: HC $2.00/MF $0.50 CSCL 21C

An arc image oven is used in the investigation of solar energy collection. Experimental heat elements have been built. The electrostatic propulsion units use mercury ions as the working medium and have a specific impulse of 3800 sec. The rail-type plasma-gun is used to study the discharge propagation. Sliding field plasma accelerators are based on the removal of the conducting medium by Foucalt currents. The electric arc propulsion units use argon and helium as propellants, and are water cooled. Author

N67-10288# Pennsylvania State Univ., University Park. Ordnance Research Lab.
AN APPLICATION OF THE FREE-PISTON PRINCIPLE TO STEAM POWERED AIR COMPRESSION
R. T. Harper 16 Aug. 1966 119 p refs
(Contract NOw-65-0123-d)
(AD-638644) CFSTI: HC $4.00/MF $0.75

The study investigated how the basic principle and methods of analysis of the conventional diesel free-piston engine could be applied to steam powered air compression. A number of possible engine design configurations were discussed to meet the specific requirements of the energy conversion unit of a closed-loop pneumatic servo control system. A mechanically simple, self-contained design configuration was chosen and analyzed in detail. The equations of motion were developed for the piston assembly of the selected design configuration. The solution of these equations was demonstrated by means of an analog computer simulation. A laboratory model was fabricated to provide experimental data for comparison with the theory and all differences between this model and the mathematical model were defined. The steam powered free-piston engine was found to have significant potential and warrants further research and development in this area Author (TAB)

N67-10496# Stanford Research Inst., Melo Park, Calif.
ROCKET MOTOR CHARGING EXPERIMENTS Scientific Report No. 2
E. F. Vance and J. E. Nanevicz Jun. 1966 96 p refs
(Contract AF 19(628)-4800)
(AFCRL-66-497; AD-638181) CFSTI: HC $3.00/MF $0.75

A study of the effect of rocket engines on electrostatic charge accumulation was made. Experiments were conducted to measure short-circuit charging current and open-circuit voltage produced by 5-inch solid-fuel rocket motors during static firings at sea level. Experiments were also performed with an ethylene-oxygen burner at reduced pressures (14 mmHg). The results of these experiments are presented and compared to the published results of related experiments. Two Nike-Cajun sounding rockets were equipped with electric field meters to measure the vehicle potential throughout the rocket flight. The field meters indicated that the maximum vehicle potential was 26-to-40 kilovolts during first-stage burning at about 3 kilometers and about 2 kilovolts during second stage burning at about 12 kilometers. At high altitudes, the field meter on the first Nike-Cajun responded to ionization present in the ionosphere and enhanced by a primary experiment. This undesired

response was successfully separated from the true field response in the field meter system designed for the second Nike-Cajun experiment. It was, therefore, possible to conclude that the potential of the second vehicle was less than 1 kilovolt at altitudes above 60 kilometers (in the ionosphere) Author (TAB)

N67-10510# Sheffield Univ. (England). Dept. of Fuel Technology and Chemical Engineering

AN INVESTIGATION OF SUPERSONIC COMBUSTION AND HETEROGENEOUS TURBULENT JET MIXING RELATED TO THE DESIGN/OPERATION OF SCRAMJETS

Ian Thomas Osgerby (Ph.D. Thesis) Oct. 1965 235 p refs
(Grant AF-EOAR-65-23)
(AFOSR-66-1855; AD-638665) CFSTI: HC $6.00/MF $1.25

Chemical kinetic calculations of the combustion time in a constant area scramjet combustion (Mo=7) indicate reaction times 0.00001 secs., and show that the combustion process is usually controlled by diffusion. The mixing process in concentric fuel/air jets is investigated by means of integral forms of the equations of motion and slow mixing requires about 50 diameter. Initial contraction of the slow inner jet is predicted by the theory, and verified by experiment. The simulation of scramjet combustion conditions by a shock tunnel is considered feasible Author (TAB)

N67-10521# Vacco Insustries, South El Monte, Calif.

MICRO-ORIFICE INJECTORS AND COMBINED INJECTOR/CHAMBERS FOR IMPROVED LIQUID ROCKET MOTOR DESIGN CONCEPTS

Marvin Adelberg and Morris M. Arnold [1966] 16 p refs
Presented at the 8th Liquid Propulsion Symp. (CPIA), NASA. Lewis Res. Center, Cleveland, 7-9 Nov. 1966

Experimental micro-orifice injectors and combined injector/chamber configurations have been designed, developed, and tested. Design concepts were conceived to permit fabrication through straightforward extrapolations of "control led-pore" manufacturing methodologies originated for production of fluid filters. Propellants introduced to the thrust chambers via micro-orifice injectors have demonstrated a superior vaporization and rocket motors employing such micro-orifice injection concepts appear to possess many operational advantages. Data is presented demonstrating combustion efficiencies attained in experimental firings utilizing storable propellants. . . N_2O_4/UDMH, 50/50. . . and performance evaluation hardware. Three designs, currently being tested, are also described. Author

N67-10559# College of Aeronautics, Cranfield (England).

THE DEVELOPMENT OF AN AIR BLAST ATOMIZER FOR GAS TURBINE APPLICATION

A. H. Lefebvre and D. Miller Jun. 1966 22 p refs
(COA-AERO-193) CFSTI: HC $1.00/MF $0.50

The relative merits of the various methods of fuel injection currently employed in gas turbines are briefly examined with particular reference to their performance in high pressure combustion chambers. This is followed by an account of an investigation that was carried out on an alternative system of fuel injection, namely air blast atomization, which appears to offer significant and worthwhile advantages over the more established methods. The results of this investigation showed that, even with the relatively low air velocities attainable in modern low-loss combustion chambers, the air blast atomizer is capable of producing fuel droplets which are comparable in size to those obtained from a swirl atomizer. It was also found that minimum droplet sizes were achieved when the fuel sheet flowing over the atomizing lip was subjected to the action of high velocity air on both sides. An air blast atomizer embodying this design feature was constructed and tests confirmed its suitability for application to gas turbines. Author

N67-10759*# General Dynamics/Convair, San Diego, Calif.

EXPERIMENTAL AND EVALUATION STUDIES OF A COAXIAL PLASMA GUN ACCELERATOR Final Report

A. V. Larson, L. Liebing, and R. Dethlefsen Jul. 1966 115 p refs
(Contract NAS3-7111)
(NASA-CR-54710; GD/C-DBE-65-026) CFSTI: HC $3.00/MF $0.75 CSCL 21C

Pulsed plasma accelerators, receiving power from capacitor banks and having the current pass through the plasma via electrode structures, were investigated. In one deivce the current distribution moves along the coaxial electrodes expelling the plasma. Several propellant distributions using radial injections were studied. A second device, the pulsed arc gun, is essentially a pulsed MPD arc, and the current distribution remains stationary. Current density and magnetic field measurements were made. It was also found that the discharge and exhaust maintain a quasi-steady state condition for most of the discharge. The third accelerator type features unique methods for axial propellant injection and for triggering the discharge. Initial work on realistic spaceflight propellant injectors is reported, and pulsed metal feed systems are considered. Power conditioning and diagnostic tools are described. N.E.N.

N67-10798*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ONSET OF ANOMALOUS DIFFUSION IN ELECTRON-BOMBARDMENT ION THRUST

Allan J. Cohen Washington, NASA, Nov. 1966 26 p refs
(NASA-TN-D-3731) CFSTI: HC $1.00/MF $0.50 CSCL 21C

Noise measurements and variations of ion production energy per beam ion with magnetic field indicate an onset of anomalous diffusion in the electron-bombardment ion thrustor. Application of the stability theory of the Kadomtsev and Nedospasov kind yielded an expression for the critical magnetic field for the onset of anomalous diffusion and an expression for the oscillatory frequency associated with the anomalous diffusion. The derived behavior of the critical magnetic field is similar to an experimentally derived scaling law for the ion thrustor. Calculated values of the critical magnetic field for mercury and argon propellants agreed well with those obtained from experimental values determined from curves of ion production energy per beam ion. Expressions for ion production energy per beam ion are given for both the classical and the anomalous regions. A theoretical value of the oscillatory frequency was calculated to be in the same frequency regime as an experimental value of a device dominated by a similar type of anomalous diffusion. Author

N67-10977# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TEST-STAND STUDY OF A FORCED JET CHAMBER FOR LIQUID FUEL

V. I. Khvostov and V. I. Solonin 31 Aug. 1966 21 p refs
Transl. into ENGLISH from Teploenerg. (Moscow), no. 5, 1965 p 77-81
(FTD-HT-66-195; TT-66-62236; AD-638897) CFSTI: HC $1.00/MF $0.50

Results are presented of experimental investigation in an effort to find the optimum design and variant of mode of operation of a forced jet combustion chamber for liquid fuel. Author (TAB)

N67-11077# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN PROBLEMS OF UNSTABLE COMBUSTION IN ROCKET ENGINE CHAMBERS DRIVEN BY LIQUID FUEL

H. Krajewski 18 Apr. 1966 18 p ref Transl. into ENGLISH from Tech. Lotnicza (Poland), no. 12, 1964 302-305
(FTD-TT-65-1728; TT-66-62276; AD-639063) CFSTI: HC $1.00/MF $0.50

The monograph discusses only certain problems of unstable combustion in a rocket engine combustion chamber, namely, the types of instability, their manifestations, causes, and possible results for the drive, stability criteria and conclusions. TAB

N67-11084# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF COMBUSTION CHAMBER FORM ON THE TENDENCY OF A CARBURETOR ENGINE TOWARD DETONATION
L. S. Sukhareva 6 Jun. 1966 25 p refs Transl. into ENGLISH from Avtomob. Prom. (Moscow), v. 30, no. 10, 1964 p 5-10
(FTD-TT-65-1857; TT-66-62283; AD-639154) CFSTI: HC $1.00/MF $0.50

Conclusions: the form of the combustion chamber and the magnitude of the displacer has a great effect on the detonation tendency of the engine. A 40% increase of the displacer from the area of the ring shows positive results of engine operation, considerably reducing its detonation tendency and increasing the index of using the detonation stability of the fuel in the engine. An increase in displacer to 60%, although it gives a reduction in requirements in octane number of the fuel, but it is accompanied by an undesirable increase in rigidity and working noise of the engine. The form of the combustion chamber and the magnitude of the displacer exert a great effect on the 'sensitivity' of the engine towards changing the ignition advancement angle, and also on the power reduction and deterioration of fuel economy of the engine when using auto gasolines with octance number, smaller than the needed one. With an increase in displacer the 'sensitivity' of the engine toward the deviation of the ignition advancement angle from its optimum value increases. The form of the combustion chamber considerably affects detonational rigidity of the engine, i.e. its ability to use the properties of 'sensitive' automobile gasolines, to change its actual octane evaluation in dependence upon exploitation conditions. It can be especially recommended the use of 'sensitive' auto gasolines for engines with wedge, cylindrical, semispherical and plane oval combustion chambers are especially recommended. Author (TAB)

N67-11092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PLASMA ROCKET: A PROMISING INNOVATION IN ROCKETRY
11 Aug. 1966 9 p Transl. into English from Repules (Hungary), v. 18, no. 5, 1965 p 14-15
(FTD-TT-65-1886; TT-66-62321; AD-639347) CFSTI: HC $1.00/MF $0.50

Translation of Hungarian research. TAB

N67-11129# Naval Ordnance Test Station, China Lake, Calif.
LETTER REPORT OF PROGRESS ON WO 11, 294B DURING PERIOD 2 JANUARY-FEBRUARY 1966
M. W. Beckstead, J. E. Crump, G. L. Dehority, H. B. Mathes, Jr., E. W. Price et al 28 Feb. 1966 18 p
(NOTS-TN-5008-25)

Activity is reported in the areas of dynamic instability, acoustic losses, and steady state burning to aid in rocket motor design. Testing of an acoustic mode burner, propellants, spontaneous combustion oscillations, and instability in axial modes. In the field of steady state burning, photography of several propellants that experienced combustion instability is described and further interpretation of single crystal AP and sandwich deflagration tests is presented. S.P.

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N67-10008# Southwestern Coll., Memphis, Tenn.
INFRARED STUDIES OF STELLAR ATMOSPHERES Final Report, 1 Mar. 1963-1 Mar. 1966
J. H. Taylor, F. R. Stauffer, and E. A. Barnhardt 28 Feb. 1966 79 p refs
(Contract AF 19(628)-2371)
(AFCRL-66-274; AD-633769)

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2. NEAR INFRARED RADIATION FROM THE SOLAR ATMOSPHERE DURING THE TOTAL SOLAR ECLIPSE OF 20 JULY 1963 J. H. Taylor and R. M. Mac Queen p 17 refs (See N67-10010 01-29)
3. INFRARED RADIOMETRIC OBSERVATIONS OF THE SOLAR CORONA DURING THE TOTAL SOLAR ECLIPSE OF 20 JULY 1963 J. H. Taylor and R. M. Mac Queen p 18-24 refs (See N67-10011 01-29)

N67-10009# Southwestern Coll., Memphis, Tenn.
OBSERVATIONS OF NEAR INFRARED RADIATION FROM THE SOLAR ATMOSPHERE
J. H. Taylor and R. M. Mac Queen *In its* Infrared Studies of Stellar Atmospheres 28 Feb. 1966 p 12-16 refs Repr. from Appl. Opt., v. 3, no. 1, Jan. 1964 p 125-129 (See N67-10008 01-29)

Observations of the radiation from the solar atmosphere have been made in the infrared region of the spectrum from 0.936 to 2.173μ. Spectra were obtained using a DF-2 prism and PbS detector. Spectra from the solar atmosphere and photosphere are compared. Uncertainties in the spatial origin of these recorded spectra are discussed. Author

N67-10010# Southwestern Coll., Memphis, Tenn.
NEAR INFRARED RADIATION FROM THE SOLAR ATMOSPHERE DURING THE TOTAL SOLAR ECLIPSE OF 20 JULY 1963
J. H. Taylor and R. M. Mac Queen *In its* Infrared Studies of Stellar Atmospheres 28 Feb. 1966 p 17 refs Repr. from Appl. Opt., v. 3, no. 12, Dec. 1964 p 1506 (See N67-10008 01-29)

Spectroscopic measurements made in the region 1.094μ to 2.304μ during the total solar eclipse of 20 July 1963 are presented. A detailed description of the spectrometer used in making the measurements is included. C.T.C.

N67-10011# Southwestern Coll., Memphis, Tenn.
INFRARED RADIOMETRIC OBSERVATIONS OF THE SOLAR CORONA DURING THE TOTAL SOLAR ECLIPSE OF 20 JULY 1963
J. H. Taylor and R. M. Mac Queen *In its* Infrared Studies of Stellar Atmospheres 28 Feb. 1966 p 18-24 refs Repr. from Appl. Opt., v. 3, no. 12, Dec. 1964 p 1365-1371 (See N67-10008 01-29)

Radiometric measurements of the solar corona have been made in the spectral region 1.15-5.1μ during the total solar eclipse of 20 July 1963. A 78.7-cm diam, f/2 radiometer equipped with a thermistor bolometer detector was employed. Four wide band interference filters were used for spectral isolation, namely, 1.15-2.60μ, 2.9-4.2μ, 4.5-5.1μ, and 7.6-13.4μ. Coronal spectral intensities were measured as a function of radial position. The radial dependence of these intensities was calculated and compared

with the van de Hulst model of the visible corona. Radiometric measurements were made during and after totality. Author

N67-10029# Belgian Royal Observatory, Uccle. Dept. of Radioastronomy and Solar Physics.
RADIOELECTRIC SOLAR ACTIVITY IN 1962, PART II [L'ACTIVITE RADIOELECTRIQUE SOLAIRE EN 1962, SECONDE PARTIE] Annual Report
J. Chiry and R. Gonze 1966 9 p refs In FRENCH *Its* Commun. No. 241
(AR-23) CFSTI: HC $1.00/MF $0.50

A summary of astronomical observations of the sun is presented. Tabular data list the variability and flux density at 600 MHz by daily averages. Principal events for the entire year are classified for SEA (sudden enhancement of atmospherics, SWF (short wave fadeout), and SCNA (sudden cosmic noise absorption). Perturbations of observed ionospheric propagation are also noted. Transl. by R.Ll.

N67-10307# Uppsala Univ. (Sweden). Cosmic Ray Group.
COSMIC RAY INTENSITY VARIATIONS DURING 1965
A. E. Sandstroem, E. Dyring, L. Ekstroem, S. Lindgren, B. Sporre et al Nov. 1960 28 p refs
(Contract AF 61(0521-868)
(AFCRL-66-523; SN-1; AD-638020) CFSTI: HC $2.00/MF $0.50

The recorders have continued as during the last years by one neutron monitor, two cubical telescopes and six inclined telescopes in Uppsala and Kiruna. Tables and figures give a detailed account of diurnal and semidiurnal variations during 1965. Only one decrease is illustrated in a one-hour diagram Author (TAB)

N67-10341# Sacramento Peak Observatory, Sunspot, N. Mex.
ON THE HARD X-RAY EMISSION OF SOLAR FLARES
L. S. Levitsky [1966] 9 p refs Transl. into ENGLISH from Izv. Krimsk. Astrofiz. Observ. (Moscow), v. 29, 1963 p 146–151
(T-27; TT-66-62143; AD-637811) CFSTI: HC $1.00/MF $0.50

A method is proposed for the determination of the effective wavelength lambda sub eff of the X-ray emission of chromospheric flares at the moment of maximum of an SID. The method is based on the utilization of data on the f sub m in reflection frequencies, obtained from World Data Center Ionospheric Stations, and is used for determining the lambda sub eff of seven flares. The derived values are within the limits 2–3 A. Author (TAB)

N67-10353# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PLASMA MEASUREMENTS
John D. Mc Carron 21 Jul. 1966 25 p refs
(Contract AF 19(628)-5167)
(TN-1966; ESD-TR-66-395; AD-637998) CFSTI: HC $1.00/MF $0.50

The existence of a corpuscular solar radiation which extends well into the solar system was proposed many years ago based on observations of geophysical phenomena. These early indirect observations of the solar plasma are reviewed here and are compared to recent direct plasma measurements from ionospheric sounding rockets and from both geocentric and heliocentric satellites. Some of the measurement techniques employed in these direct observations are discussed in detail. Author (TAB)

N67-10356# Sacramento Peak Observatory, Sunspot, N. Mex.
STUDY OF MOTION AND EMISSION OF SOLAR PROMINENCES
A. B. Severny and V. L. Khokhlova [1966] 40 p refs Transl. into ENGLISH from Izv. Krimsk. Astrofiz. Observ. (Moscow), v. 10, 1953 p 9–53
(T-25; TT-66-62140; AD-637808) CFSTI: HC $2.00/MF $0.50

In this work are presented results of measurements of motion and changes of brightness in prominences from movies obtained in H-alpha of hydrogen by means of a narrow-band interference-polarization filter in 1948-1950 and for a short time in 1951. The discussion of results of measurements of motions allows the authors to: (1) divide all prominences into three classes (according to the type of predominant motion in them), and to give detailed characteristics of these classes and specific motions for them; (2) to obtain some knowledge of the nature of observed motions in prominences (motions of electromagnetic and turbulent character); (3) to obtain knowledge of the spectra of turbulence in the solar atmosphere. Study of the changes in brightness allows the authors: (1) to detect variations in emission of knots and jets and to find the relationship of radiation-damping time to size of knot; (2) to detect flares in the emission of eruptive prominences and to find their connection with sudden changes in velocity of motion. There is indicated the possibility of explaining radiation damping of knots by a process of heating of the prominence by the surrounding corona. Author (TAB)

N67-10382# Manila Observatory (Philippines).
SOLAR PATROL, OCTOBER 1966
[1966] 10 p Sponsored by ESSA

Maps of solar filaments and prominences for October 1966 recorded by the Manila Observatory are presented. Also included are tabulated data, which includes six additional events for September 1966, on time, coordinates, area, etc., of these activities. R.N.A.

N67-10439# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE PRODUCTION OF COSMIC GAMMA RAYS IN INTERSTELLAR AND INTERGALACTIC COSMIC-RAY COLLISIONS. I: THE KINEMATICS OF P-P INTERACTIONS AND SECONDARY MESON AND HYPERON DECAY AND THE COSMIC GAMMA-RAY SPECTRAL SOURCE FUNCTION
F. William Stecker 31 Aug. 1966 65 p refs
SAO Special Rept.-220)

From the results of experimental particle physics and the relativistic kinematics of particle decay expressions are derived for calculating the source functions for the production of gamma rays from the secondary mesons and hyperons produced in high-energy p-p interactions. Gamma rays are considered to be produced from the decays of secondary neutral pions, neutral and charged kaons, lambda particles, and neutral and charged sigma particles. The resultant source-function expressions are given in terms of production functions in the form of Green's functions for the secondary particles listed above. These production functions may then be obtained from proton accelerator data and cosmic-ray air shower data and, in conjunction with the expressions derived, can be used to compute the gamma-ray source functions and resultant cosmic gamma-ray spectrum generated by high-energy p-p interactions. Author

N67-10452# Environmental Science Services Administration, Boulder, Colo. Inst. for Telecommunication Sciences and Aeronomy.
SOLAR-GEOPHYSICAL DATA
Jul. 1966 68 p
(CRPL-FB-263)

The tabulated data covers the year July 1965–June 1966, and includes: daily solar indices, solar centers of activity, solar flares, solar radio waves, cosmic ray indices, geomagnetic activity indices, radio propagation quality indices, and alert periods and special world intervals. N.E.N.

N67-10493# Sacramento Peak Observatory, Sunspot, N. Mex.
THE MOTION OF CA+ IN THE CHROMOSPHERE AND THE CONNECTION OF MOTION WITH MAGNETIC FIELDS
V. E. Stephanov [1960] 23 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 23, 1960 p 184–211
(T-24; TT-63-16438; AD-637810) CFSTI: HC $1.00/MF $0.50

The magnetograph and recorder of radial velocities of the Crimean Astrophysical Observatory were used for measuring the longitudinal magnetic field in line Fe lambda 5250 A and radial velocities and brightness in H3Ca(+). The radial velocity field above active solar regions in flocculi and in undisturbed chromospheric regions was investigated. The radial velocities were compared with the magnetic field distribution at the photospheric level. It was established that in the chromosphere there are extensive regions, with ascending and descending gas, which extend up to 200,000 km. The motion in these regions has the character of large-scale turbulence. The characteristic scale of the elements is 5000-20,000 km and the life-time approx. 7 hours. The total mean velocity of turbulent elements is 3.6 km/sec. In the undisturbed chromosphere the mean velocity of the ascending gas is -0.96 km/sec and the descending +1.25 km/sec. The area from which there is an upward rise of gas comprises 56% of the whole area of the undisturbed chromosphere. The total flow of the ascending mass is equal to the downwardflow. Inflocculi the mean velocity of ascending gas is -0.97 km/sec and descending +1.7 km/sec. The area with a downward flow of gas is more than three times larger than that with an upward flow. The flow of descending gas exceeds that of the ascending gas by a factor of 4
Author (TAB)

N67-10657# Osservatorio Astronomico di Roma (Italy).
SOLAR PHENOMENA Monthly Bulletin No. 104
Massimo Cimino Aug. 1966 13 p CFSTI: HC $1.00/MF $0.50

Data tables are presented which contain the daily total areas of sunspot groups observed during August, 1966, and the heliographic position, classification, and area of sunspot groups observed during July, 1966. Consideration is also given to longitudinal sunspot magnetic fields, hours of K-line and H_χ cinematographic patrols, sudden cosmic noise absorption, and sudden enhancement of atmospherics.
A.G.O.

N67-10708# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
GAMMA RADIATION IN SPACE AND IN THE ATMOSPHERE [RAYONNEMENT GAMMA DANS L'ESPACE ET DANS L'ATMOSPHERE]
Robert Rocchia (Ph.D. Thesis--Paris Univ., Orsay, France) 1966 65 p refs In FRENCH
(CEA-R-2939)

It is shown that the γ radiation existing in the atmosphere is caused mainly by the bremsstrahlung of the electrons of the electromagnetic cascades (~50% of the measured radiation), by the 511 kev radiation produced by the annihilation of positrons created in cascades (8% of the measured intensity) and by the Compton γ degradation of this line (30% of the measured intensity). The rest, slightly over 10%, must be attributed to secondary causes such as the nuclear de-excitation γ to the internal bremsstrahlung of charged particles created in nuclear stars, and to charged particles crossing our detector, since the latter was not fitted with a device for rejecting these particles. Experiments carried out in rockets at Colomb-Béchar confirm these results and have made it possible to detect and measure a primary γ radiation having an intensity of $\sim 2\gamma cm^{-2}s^{-1}$ above 100 kev. The primary spectrum obeys an approximate E^{-2} law.
Author (NSA)

N67-10871*# California Univ., La Jolla. Dept. of Physics.
THE UPPER LIMIT SOLAR GAMMA-RAY SPECTRUM TO 10 MeV
Laurence E. Peterson, Daniel A. Schwartz, R. M. Pelling, and David Mc Kenzie 18 Aug. 1966 11 p refs Submitted for Publication
(Contract NAS5-3177; Grant NsG-318)
(NASA-CR-79715; UCSD-SP-66-6) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Data obtained in part from a balloon flight series are compiled to form a composite upper limit gamma ray spectrum from the quiet sun over the 20 keV to 10 MeV range. This is about a factor of thirty below previous observations from the OSO-I. Observations in the lower energy range were obtained with the prototype version of an X-ray detector originally deisgned for an OSO satellite; this consists of a 3 mm thick×10 cm^2 area NaI scintillation counter with an anticoincidence collimating shield of CsI. Results in the 1 to 10 MeV range were obtained using a 3"×3" NaI scintillation counter, which has an omnidirection geometry factor of 67 cm^2 and nearly an isotopic response. This was flown at 126,000 feet during a night-day flight, with the solar flux obtained from the diurnal variation of counting rates. Measurements and estimates on the quiet sun gamma ray spectrum are depicted; it is shown that the hot solar corona produces a steep free-free emission spectrum which must join smoothly onto the estimated albedo flux due to cosmic ray interactions in the solar surface. Background fluxes and solar upper limits are tabulated.
M.G.J.

N67-10873*# California Univ., La Jolla. Dept. of Physics.
THE SPECTRUM OF SCORPIUS XR-1 TO 50 KeV
Laurence E. Peterson and Allan S. Jacobson 21 Jul. 1966 8 p refs Submitted for Publication
(Contract NAS5-3177; Grant NsG-318)
(NASA-CR-79717; UCSD-SP-66-4) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Balloon telescopic measurements, utilizing a 3 mm thick NaI scintillation counter surrounded by a CsI anticoincidence collimating shield, are reported for the strongest X-ray source in Scorpion. The observed characteristic spectrum indicates the consistence of an optically thin hot gas at 50×10^8°K with a flattening tail above 35 keV; this non-thermal tail extends to about 50 KeV and contains a flux of 0.03 photons/cm^2-sec. Reported measurements were only obtained during the summer of 1965, and repeated attempts at re-observation failed.
G.G.

N67-10885*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
ON THE STABILITY OF AN EQUILIBRIUM STATE FOR THE INTERSTELLAR GAS AND MAGNETIC FIELD
I. Lerche Oct. 1966 27 p refs
(Grant NsG-96-60)
(NASA-CR-79744; EFINS-66-95) CFSTI: HC $2.00/MF $0.50 CSCL 03B

The stability of a simple equilibrium periodic system for the interstellar gas--magnetic field is discussed, and it is demonstrated that the system is unstable with a gorwth time of the order of the free-fall time. The instability is of such a nature that the material tends to break up into clumps. In view of the fact that the periodic system is formed from a uniform atmosphere in a time of the same order, this calculation demonstrates that, at best, the periodic system can represent a transition phase of the interstellar gas--magnetic field system. It also shows that the formation of clumps of gas from a uniform atmosphere progresses in a time less than, or comparable to, the free-fall time.
Author

N67-10888*# Air Force Systems Command, Kirtland AFB, N. Mex. Weapons Lab.
A COMPUTATIONAL MODEL FOR GEOMAGNETICALLY TRAPPED PARTICLE SHELLS AND KINEMATIC PARAMETERS Technical Report, Oct. 1965-Jun. 1966
Juan G. Roederer (NASA Goddard Space Flight Center) and James V. Herod Sep. 1966 78 p refs Prepared in Cooperation with Goddard Space Flight Center
(NASA-CR-79705; AFWL-TR-66-78; AD-639436) CFSTI: HC $3.00/MF $0.75 CSCL 04A

A computer program has been constructed which calculates a model for geomagnetically trapped particle shells and the associated kinematic parameters. Included is the calculation of

longitude-dependent drift velocities and bounce paths. This document explains the methods used in constructing the program as well as the input and output of the code Author (TAB)

N67-10906# Case Inst. of Tech., Cleveland, Ohio.
RESEARCH PROGRAM IN NEUTRINO PHYSICS, COSMIC RAYS AND ELEMENTARY PARTICLES Technical Report, 1 Oct. 1965–30 Sep. 1966
Frederick Reines et al Jul. 1966 33 p refs
(Contract AT(11-1)-818)
(COO-818-96) CFSTI: HC $2.00/MF $0.50

A modified version of the table top study of $\bar{\nu}_e+p$ which may not require detection of the delayed coincidence between product positron and neutron is discussed. If the study is successful a measurement of significantly greater accuracy will result since only the positron is involved and hence the uncertainties in the neutron detection efficiency will be eliminated. The equipment being readied for a second improved approach to the detection of double beta decay of ^{150}Nd is described. A large (360 Kgm) composite NaI-plastic detector for the detection of the elastic scattering reaction ($\bar{\nu}_e+e^- \rightarrow \bar{\nu}_e+e^-$) was developed. Some preliminary measurements were made of its characteristics and development of the associated electronics is outlined. The equipment for two solar neutrino experiments (ν_e+d and ν_e+^7Li) in the Morton Salt Company mine is also described. Some preliminary tests were made of a Cerenkov D_2O system. A slight modification of the D_2O system promises to give a new test of baryon conservation which makes fewer assumptions than previous experiments. The latest and most ambitious test to date of the principle of baryon conservation is reported. Assuming modes of decay which violate only baryon and lepton conservation the lifetime is $>2\times10^{28}$ or 8×10^{29} years, depending on the specific mode. This represents an improvement in the limit by an order of magnitude. A discussion is also presented on the South African experiment which has continued to produce data on neutrinos and cosmic rays deep underground. A directional Cerenkov detector section was installed to distinguish neutrinos which penetrate the earth from below. A solar neutrino detector designed to detect the sun via the elastic scattering reaction was also installed and is under preliminary tests. NSA

N67-10959# Northrop Space Labs., Hawthorne, Calif.
A SPACEFLIGHT EXPERIMENT TO ASSESS RADIATION SHIELDING CALCULATIONS Final Report, 1963–Oct. 1965
William H. Coop and Mac C. Chapman Wright-Patterson AFB, Ohio. AMRL Apr. 1966 23 p refs
(Contract AF 33(657)-11010)
(NSL-65-158; AMRL-TR-66-34; AD-638920) CFSTI: HC $3.00/MF $0.75

The design, development, and testing of a spaceflight experiment to provide data for the assessment of mathematical shielding study models was investigated. The experiment was to provide data for assessment of mathematical shielding study models for comparison with the results obtained by a computer program. This experiment measured proton depth-dose distribution, bremsstrahlung production, and the effects of radiation anisotropy, energy spectrum, and vehicle heterogeneity under known (measured) conditions of radiation environment and vehicle geometry. The experiment instrumentation included sensors for measurement of proton and electron fluxes and spectra, and sensors to measure dosage under various shielding thicknesses of aluminum. An instrument to measure x-ray bremsstrahlung from incident electron flux was also provided. The instrument design features are discussed and methods of operation described Author (TAB)

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N67-10001# Royal Greenwich Observatory, Herstmonceux (England).
RADIAL-VELOCITY OBSERVATIONS OF RR LYRAE VARIABLES AT KOTTAMIA. PHOTOMETRIC OBSERVATIONS OF RR LYRAE VARIABLES
1966 38 p refs HMSO: 5s 6d

CONTENTS:

1. RADIAL-VELOCITY OBSERVATIONS OF RR LYRAE VARIABLES AT KOTTAMIA K. Aly (Helwan Obs., Cairo) and R. Woolley 18 p refs (See N67-10002 01-30)

2. PHOTOMETRIC OBSERVATIONS OF RR LYRAE VARIABLES G. A. Harding and M. J. Penston 19 p refs (See N67-10003 01-30)

N67-10002# Royal Greenwich Observatory, Herstmonceux (England).
RADIAL-VELOCITY OBSERVATIONS OF RR LYRAE VARIABLES AT KOTTAMIA
Richard Woolley and Khairy Aly (Helwan Obs., Cairo) *In its* Radial-Velocity Observations of RR Lyrae Variables at Kottamia 1966 18 p refs *Its* Roy. Obs. Bull. No. 114 (See N67-10001 01-30) HMSO: 5s 6d

Observations of radial velocity of 18 RR Lyrae variable stars observed with the new 74-inch telescope are described. In most cases sufficient observations have been made to construct a velocity curve and therefore to give a mean velocity of high weight. For seven of the stars observed no velocity at all was previously available, and for another seven the velocity previously available depended upon a single plate. The velocity amplitudes are determined in most cases. These can be correlated very well with the period of the star, and rather less well with the amplitude of the light variation. Author

N67-10003# Royal Greenwich Observatory, Herstmonceux (England).
PHOTOMETRIC OBSERVATIONS FOR RR LYRAE VARIABLES
G. A. Harding and Margaret J. Penston *In its* Radial-Velocity Observations of RR Lyrae Variables at Kottamia 1966 19 p refs Its Roy. Obs. Bull. No. 115 (See N67-10001 01-30) HMSO: 5s 6d

Photometric observations, in blue light, of 22 RR Lyrae variables are presented. In seven cases new light-curves in *B* are shown and the amplitude is determined. For the remaining stars uncalibrated curves, used to obtain an up-to-date epoch of maximum light and period, for correlation with the radial-velocity work presented in the previous bulletin, are given. Author

N67-10004# Belgian Royal Observatory, Uccle.
THE RELATIVE RECTILINEAR MOTION OF THE COMPANION STAR OF A VISUAL DOUBLE STAR [LE MOUVEMENT RELATIF RECTILIGNE DU COMPAGNON D'UNE ETOILE DOUBLE VISUELLE]
S. Arend 1966 28 p refs In FRENCH *Its* Commun., Ser. B, No. 6 CFSTI: HC $2.00/MF $0.50

The rectilinear orbit of the companion star of a visual double star is calculated from observed polar coordinates of a system of rectilinear axes. The polar coordinates are shown graphically and the relative positions of the secondary star are plotted on a straight line. A determination is made of the two parameters of a linear

function, and the general classical solution to the problem is derived by at least squares method. Orbital elements and vectoral constants, as well as a system of equations representing the rectilinear orbit, are presented. Several examples of calculation for certain double stars are included. Transl. by R.U.

N67-10054# Radio and Space Research Station, Slough (England).
CATALOGUE OF DATA RECEIVED BETWEEN 1ST JANUARY 1966–30TH JUNE 1966
[1966] 29 p refs CFSTI: HC $2.00/MF $0.50

Rocket data are presented in tabular form by country of origin, rocket number, and launch date and satellite data by country of orgin, name, type, and period. The data were compiled from such sources as reports of the meteorological rocket network, positional observations, and Smithsonian Astrophysical Observatory special reports. L.E.W.

N67-10061*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR I MISSION REPORT. PART II: SCIENTIFIC DATA AND RESULTS
10 Sep. 1966 112 p refs
(Contract NAS7-100)
(NASA-CR-79150; JPL-TR-32-1023) CFSTI: HC $4.00/MF $0.75
CSCL 22A

CONTENTS:

1. SUMMARY L. D. Jaffe and E. M. Shoemaker p 1–2 (See N67-10062 01-30)
2. INTRODUCTION L. D. Jaffe and S. E. Dwornik p 3–6 ref (See N67-10063 01-31)
3. LUNAR SURFACE TOPOGRAPHY J. J. Rennilson, J. L. Dragg, E. C. Morris, E. M. Shoemaker, and A. Turkevich p 7–44 refs (See N67-10064 01-30)
4. LUNAR SURFACE THERMAL CHARACTERISTICS J. W. Lucas, J. E. Conel, R. R. Garipay, W. A. Hagemeyer, and J. M. Saari p 45–59 refs (See N67-10065 01-31)
5. LUNAR SURFACE ELECTRICAL PROPERTIES W. E. Brown p 61–67 (See N67-10066 01-30)
6. LUNAR SURFACE MECHANICAL PROPERTIES E. M. Christensen, S. A. Batterson, H. E. Benson, C. E. Chandler, R. H. Jones et al p 69–85 refs (See N67-10067 01-30)
7. ASTRONOMY R. H. Norton, J. E. Gunn, W. C. Livingston, G. A. Newkirk, and H. Zirin p 87–91 (See N67-10068 01-30)

APPENDIX
8. OBSERVATIONS OF DUST PARTICLES W. A. Hagemeyer p 93–97 refs (See N67-10069 01-30)

N67-10062*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SUMMARY
L. D. Jaffe and E. M. Shoemaker *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 1–2 (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

A summary of the scientific accomplishments of Surveyor I on the lunar surface is given, including photography, temperature measurements, surface observations, and radar cross section. K.W.

N67-10064*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SURFACE TOPOGRAPHY
J. J. Rennilson, J. L. Dragg, E. C. Morris, E. M. Shoemaker, and A. Turkevich *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 7–44 refs (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

Characteristics, capabilities, and operations of the Surveyor I camera system are initially discussed, followed by an evaluation of the photographs and data that were obtained. Covered are: (1) landscape features on horizon; (2) general slope of landing site; (3) morphology and structure of terrain around spacecraft; (4) size distribution of small craters; (5) distribution of blocks and coarse debris; (6) size distribution of debris on lunar surface and characteristics of fine matrix; (7) cohesion and thickness of surficial fragmental layer; (8) material ejected by impact of spacecraft footpad; and (9) photometry and colorimetry. Graphs, tables, and selected photographs are included. K.W.

N67-10066*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SURFACE ELECTRICAL PROPERTIES
W. E. Brown *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 61–67 (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

Two radar systems were used on the spacecraft; they were the altitude marking radar, and the radar altimeter and Doppler velocity sensor radar. Parameters and performance of the two systems are discussed. It is concluded that (1) radar cross section values are approximately as expected from earth-based measurements; (2) echo was returned by the visible surface or within 30 cm to 60 cm of the surface; (3) plumes of the vernier engines had no measurable effect upon the radar signal strength; and (4) one of the off-normal beams traversed a crater-like surface anomaly approximately 1 km wide and 2 km southwest of the touchdown point. K.W.

N67-10067*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SURFACE MECHANICAL PROPERTIES
E. M. Christensen, S. A. Batterson, H. E. Benson, C. E. Chandler, R. H. Jones et al *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 69–85 refs (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

This interpretation of the lunar surface properties is based on (1) pictures that show the lunar surface area disturbed by the footpads and the crushable blocks, and (2) histories of axial loads in the shock absorbers on each of the three legs during the landing. A detailed description is given of the landing gear and the sequence of descent and touchdown. Final descent velocities and attitudes were determined by studying and correlating the velocity data from the radar altimeter and Doppler velocity sensor, the three gyro angular rates about the spacecraft axis, and the precise timing of the final descent and touchdown events. The analytical simulations of the landing dynamics, based upon extensive computer simulation studies, are also briefly discussed. K.W.

N67-10068*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASTRONOMY
R. H. Norton, J. E. Gunn, W. C. Livingston, G. A. Newkirk, and H. Zirin *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 87–91 (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

The attempt to photograph the outer solar corona with the Surveyor I TV camera after the solar disk had set below the western horizon is described. Four representative pictures, taken on June 14, 1966, are presented together with relevant data. Preliminary visual examination of the pictures shows a measurable radiance out to an estimated 3 to 4 solar radii from the center of the disk and a very prominent coronal streamer pointing slightly south of the ecliptic. The horizontal extent of the corona is found to be larger than expected. K.W.

N67-10069*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPENDIX A: OBSERVATIONS OF DUST PARTICLES
W. A. Hagemeyer *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 93–97 ref (See N66-10061 01-30) CFSTI: HC $4.00/MF $0.75

Compared are TV pictures, taken on two different days, showing the location of dust particles on the radiators of the thermal compartments. Some changes in the apparent dust location

are pointed out. A laboratory simulation was made subsequent to the flight, and the results are briefly discussed. K.W.

N67-10183*# National Aeronautics and Space Administration, Washington, D. C.
SPACE TECHNOLOGY STUDIES PROGRAM [PROGRAMME D'ETUDES TECHNIQUES SPATIALES]
Jun. 1963 36 p Transl. into ENGLISH of a report from Centre Natl. d'Etudes Spatiales–Direc. Sci. et Tech. France, 1963–1965
(NASA-TT-F-8445) CFSTI: HC $2.00/MF $0.50 CSCL 22B

Short-term studies, on-board rocket tests, and the technological preparation for future missions of the space technology studies program are reported. Scientific data are presented on: chemical, electrical, and nuclear propulsion for spacecraft, satellite materials and structure, power plants, optical and scientific instruments, data processing, communications and tracking, guidance and stability, environmental standards and tests, advanced missions studies, and electronic components operational reliability. R.LI.

N67-10185*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH PROBLEMS OF SPACE TRAVEL [FORSCHUNGSPROBLEME DER RAUMFAHRT]
Ernst Stuhlinger (NASA. Marshall Space Flight Center) Apr. 1963 10 p Transl. into ENGLISH of the paper presented at Europaeischer Raumfahrt-Kong., Stuttgart, 22–25 May 1963
(NASA-TT-F-8460) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The space travel engineer's method of development of research problems through careful preparation of technical projects is briefly covered. The three categories of space travel research problems cited are: (1) problems which must be solved before the completion of existing development projects; (2) problems whose solution will improve and further the existing projects; and, (3) problems which belong to the category of basic research in preparation of future projects. Tables are included for some examples of these categories. R.LI.

N67-10188*# National Aeronautics and Space Administration, Washington, D. C.
REPORT ON FRENCH SPACE RESEARCH
[1963] 10 p Transl. into ENGLISH of extracts of a report on Centre Natl. d'Etudes France, Oct. 1962 p 9–12, 39–41, 44–46, 109–110
(NASA-TT-F-8594) CFSTI: HC $1.00/MF $0.50 CSCL 22A

The space research program work continued on sounding rockets, rocket firings, geographic installation deployment, administrative organization, and construction of the FR-1 satellite. No propulsion failures were encountered in the fifty rocket firings. The establishment of some rocket installations in France is reported, and nose cone failures are mentioned. A photographic reproduction of the FR-1 satellite is included. R.LI.

N67-10190*# National Aeronautics and Space Administration, Washington, D. C.
THE VALUE OF GEOGRAPHIC-GEOLOGIC METHODS OF STUDYING THE MOON [ZNACHENIYE GEOGRAFO-GEOLOGICHESKIKH METODOV IZUCHENIYA LUNY]
Yu. A. Khodak, V. V. Kozlou, I. N. Tomson, and L. V. Khoroshilov Feb. 1964 9 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 1, no. 3, Dec. 1963 p 460–464
(NASA-TT-F-8834) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Geographic and geologic methods of studying the moon, especially those based on structural geomorphology and structural and historical geology, are discussed. It is suggested that lunar research would benefit from the integration of geographic-geologic (as compared with terrestrial material) and astronomical methods of study. Geographic-geologic investigations already carried out are reviewed, together with the meteoritic theory of the development of lunar surface and structure. R.LI.

N67-10193*# National Aeronautics and Space Administration, Washington, D. C.
VISUAL SATELLITE OBSERVATIONS CONDUCTED BY THE STADE TRACKING STATION
Horst Köhnke Apr. 1965 5 p Transl. into ENGLISH of the book "Visuelle Satellitenbeobachtungen Durchgeführt von der Satellitenstation Stade" West Germany
(NASA-TT-F-9320) CFSTI: HC $1.00/MF $0.50 CSCL 22C

COSPAR Station No. 2567 reports tracking observations of the following satellites: Echo I, Echo II, Cosmos 44, Cosmos 53, Cosmos 59, Kappa 1, Midas IV, and Voskhod 2. Some new satellites observed are also listed. R.LI.

N67-10194*# National Aeronautics and Space Administration, Washington, D. C.
VISUAL SATELLITE OBSERVATIONS FROM SATELLITE STATION STADE
Horst Köhnke Jun. 1965 8 p Transl. into ENGLISH of the book "Visuelle Satellitenbeobachtungen Durchgeführt Von Der Satellitenstation Stade" West Germany
(NASA-TT-F-9408) CFSTI: HC $1.00/MF $0.50 CSCL 22C

Tracking, observation, and positioning data are tabulated for both new satellites and those already cataloged. Variations in brightness on specified dates and at certain altitudes are reported. Light changes and tumbling condition are also recorded at Greenwich mean time. R.LI.

N67-10195*# National Aeronautics and Space Administration, Washington, D. C.
VISUAL SATELLITE OBSERVATIONS FROM SATELLITE STATION STADE
Horst Köhnke Jun. 1965 6 p Transl. into ENGLISH of the book "Visuelle Satellitenbeobachtungen Durchgeführt von der Satellitenstation Stade" West Germany.
(NASA-TT-F-9416) CFSTI: HC $1.00/MF $0.50 CSCL 22C

Tabular data are presented for visual satellite observations from satellite station Stade, at coordinates 53° 35' 20"N, and 350° 32' 24"W. In the catalog of satellite passes, details are listed according to observation date, type of object or satellite, GMT time, brightness, magnitude, altitude, light change observed, or tumbling condition. Newly observed satellites are listed, in addition to the following: Polet I, Elektron 1, Cosmos 61, Cosmos 62, Cosmos 63, Molnija 1, Transit IIA, Tiros V, and Tiros VII. R.LI.

N67-10232*# National Aeronautics and Space Administration, Washington, D. C.
AN ACHIEVEMENT WHICH WILL NEVER BE FORGOTTEN BY MANKIND [PODVIG, KOTOROGO NE ZABUDET CHELOVECHESTVO]
F. Lushnikov Jan. 1964 11 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 14 Dec. 1963 p 3–4
(NASA-TT-F-8598) CFSTI: HC $1.00/MF $0.50 CSCL 22

A few of the comments contained in the notebooks kept by the cosmonauts aboard Vostok 5 and 6 are presented. Among the entries are observations regarding the equipment and working conditions in the spaceships, performing biological functions while in a state of weightlessness, their diet, the objects seen on earth, and other activities. H.S.W.

N67-10233*# National Aeronautics and Space Administration, Washington, D. C.
VISUAL SATELLITE OBSERVATIONS FROM SATELLITE STATION STADE [VISUELLE SATELLITENBEOBACHTUNGEN DURCHGEFUEHRT DER SATELLITENSTATION STADE]
Horst Kohnke Apr. 1965 5 p Transl. into ENGLISH from GERMAN
(NASA-TT-F-9314) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Charted data obtained from these observations are presented. The data includes the date of the observation, the revolution

number, the object observed and its code name, the time of the observation, the magnitude, and the light change tumbling period. H.S.W.

N67-10240*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A SPACE MISSION SUCCESS EVALUATION MODEL
Robert G. Chamberlain 15 Oct. 1966 39 p
(Contract NAS7-100)
(NASA-CR-79322; JPL-TR-32-961) CFSTI: HC $2.00/MF $0.50 CSCL 22A

High among the considerations involved in the planning of space missions is the probable success of the mission. The determination of this value can lead to answers to such important questions as: (1) Is the probable return sufficiently high to justify the planned allocation of resources and is the risk (probability of an insufficient return) satisfactorily low? (2) How should the currently available resources be allocated to maximize the probable success? (3) Which of the multitude of possible changes in design will give the greatest increase in probable return for the least expenditure of additional resources? The approach presented shows a technique for determining a quantitative measure of success, a procedure for evaluating this measure both a priori and a posteriori, a systematic technique for collecting and displaying the necessary input information, and a method for determining the optimal allocation of resources. Author

N67-10253*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AVERAGE PROPERTIES OF THE SOLAR WIND AS DETERMINED BY MARINER II
Marcia Neugebauer and Conway W. Snyder 1 Nov. 1966 37 p refs
(Contract NAS7-100)
(NASA-CR-79321; JPL-TR-32-991) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Positive-ion component properties of the solar wind are summarized for the four months of the *Mariner II* flight to and past Venus in 1962. Average proton velocity and temperature were approximately 500 km/sec and 1.7×10^{5}° K, respectively. Several streams of hot, high-velocity plasma were observed to recur at 27-day intervals, with peak velocity and temperature values of ≈830 km/sec and 9×10^{5}° K. One of these streams probably existed for at least 18 months. Between streams, velocity dropped to a low of 307 km/sec, while the temperature was $\approx 3 \times 10^{4}$° K. Near 1 AU, average density was approximately 5 protons/cm^3. The density was usually highest at the leading or western edge of each stream, with a maximum value of ≈80 protons/cm^3. Otherwise, the density varied inversely with the plasma velocity. Ion velocity, temperature, and density were calculated by fitting data to isotropic Maxwell–Boltzmann distributions in a reference frame moving away from the Sun at the solar-wind velocity. Observed spectra usually had high-energy tails, which became more pronounced at the higher plasma velocities. The velocity, temperature, and high-energy tail were not strongly dependent on distance from the Sun, whereas the density varied approximately as the inverse square of this distance. Author

N67-10345# RAND Corp., Santa Monica, Calif.
A PROPOSED COMPUTATIONAL METHOD FOR ESTIMATION OF ORBITAL ELEMENTS, DRAG COEFFICIENTS AND POTENTIAL FIELD PARAMETERS FROM SATELLITE MEASUREMENTS. I: INTRODUCTION
J. D. Buell, H. H. Kagiwada, and R. E. Kalaba Aug. 1966 20 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-5060-PR; AD-638397) CFSTI: HC $1.00/MF $0.50

A new computational approach is presented for estimating the density of the Earth's atmosphere at high altitudes, based on measurements of a satellite's motion through the atmosphere. The problem is formulated as a nonlinear multipoint boundary value problem that can be solved using quasilinearization and high speed digital computers. A general machine program has been written in Fortran IV, and the results of some illustrative preliminary tests are presented. Author (TAB)

N67-10433# Library of Congress, Washington, D. C. Aerospace Technology Div.
SOVIET LONG-RANGE SPACE-EXPLORATION PROGRAM Surveys of Foreign Scientific and Technical Literature
Vladimir E. Mutschall 18 May 1966 29 p refs Anal. Surv.
(ATD-66-57)

Information in Soviet publications that seems to point to the existence of other civilizations in space was collected along with possible methods which could be used to establish contact with such civilizations. It was maintained that the orbit of an habitable planet must be close to circular around its star and should not exceed an eccentricity of 0.5 in order to maintain the even temperature range conducive for life. The main condition necessary for the first stage in development of matter leading to the origination of life is the formation of hydrocarbons on any celestrial body; the second step is the formation of complex organic compounds, especially protein bodies. Methods for microbiological analyses of meteorites are being developed in order to ascertain the existence of exterrestrial life. Also discussed are possible radio communications with objects situated on high galactic latitudes; the expectation that some return signal might come from one of the closer stars where intelligent life may exist; the theory that the tiny Mars moons, Phobos and Deimos, are artificial bodies placed into a Mars orbit by a highly advanced civilization; and the radiation intensity changes of the radio source CTA-102. G.G.

N67-10561# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
ON THE SOLAR DIFFERENTIAL ROTATION
Takeo Sakurai Apr. 1966 71 p refs
(UTIAS-112) CFSTI: HC $3.00/MF $0.75

The assumption of nonisotropic eddy viscosity is examined to provide a direct quantitative comparison of theory and observation for problem of the solar differential rotation. The basic equations are taken from the results of the mixing length theory of turbulence; the important differences are as follows: (1) The effect of the variation of the density on the eddy viscosity is taken into account by assuming that the turbulent velocity is constant and the mixing length is equal to the scale height. (2) It is also assumed that the rotational speed on the inner boundary of the hydrogen convection layer is that of the solid body rotation. (3) A perturbation method was applied with respect to the small parameter ϵ which is the ratio of the thickness of the hydrogen convection layer to the solar radius. The solution for the first order approximation was obtained by series expansion. The comparison shows that the agreement is almost complete up to about 40 degrees latitude. The largest discrepancy is 13.4% at the pole provided that the thickness of the hydrogen convection layer is 12.5% of the solar radius and that the parameter corresponding to the nonisotropy of the eddy viscosity is 1.5. Author

N67-10731# California Univ., La Jolla.
ORIGIN OF THE MOON
Harold C. Urey Jun. 1966 20 p refs Presented at the Mantles of the Earth and Terrestrial Planets, Newcastle-upon-Tyre, England, 30 Mar.–7 Apr. 1966
(Contract AT(11-1)-34)
(UCSD-34P43-5; CONF-660331-1) CFSTI: HC $1.00/MF $0.50

A review is presented of various hypotheses on the origin of the moon. NSA

N67-10742*# National Aeronautics and Space Administration, Washington, D. C.
PROJECT GEMINI
[1966] 51 p
(NASA-TM-X-59048) GPO: HC $0.45; CFSTI: MF $0.50 CSCL 22A

A narrative account is given of the various phases of Project Gemini. The goal of the Gemini program was defined as the further development of spacecraft and launch vehicles; extension of the ground procedures for tracking, communication, and control; and preparation of astronauts for operations of increased complexity and difficulty. The systems, structure, and components of the Gemini spacecraft are discussed, and a diagram illustrates the Gemini instrument panel. The Gemini menu is considered, as well as other environmental control phases. The design and functions of The Gemini space suit are described, and photographs depict components, cutaway versions, and testing of the suit. The selection and training of the astronauts are covered, and the relation of their training to actual missions is considered. The Gemini–Titan and Atlas–Agena launch vehicles are described, and their operation, transport, erection, and firing are extensively illustrated. The Gemini missions are delineated including maneuvering, extravehicular activity, rendezvous and docking, effective functioning for two weeks, and control of the spacecraft during descent and landing. Finally, the Apollo mission is briefly outlined. L.E.W.

N67-10744*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A MANUAL METHOD FOR CONTROL OF THE THRUST AXIS DURING PLANAR ASCENT FROM THE LUNAR SURFACE TO A CIRCULAR ORBIT
Herman S. Fletcher and L. Keith Barker Washington, NASA, Nov. 1966 44 p refs
(NASA-TN-D-3681) CFSTI: HC $2.00/MF $0.50 CSCL 22C

The possible use of a simple control reference to aid thrust-axis orientation during the ascent of the lunar module from the lunar surface to a rendezvous with the command and service module and circular orbit at 80 n. mi. was analyzed. A fuel-optimum ascent was computed based on a constant-thrust continuous-burn powered trajectory to a circular orbit at 50,000 ft, a short thrusting period to establish a transfer trajectory from 50,000 ft to 80 n. mi., and a short thrusting period to circularize the orbit at 80 n. mi. The references examined were the horizons, a star, the takeoff site, and an orbiting spacecraft. Although no one method exhibited any significant advantages over the others, the downrange horizon was chosen for further study since it was visible from the overhead window of the lunar module for most of the launch maneuver. It was found that use of the downrange horizon as a reference point permitted a near-optimum trajectory if two constant angles were used. L.E.W.

N67-10785*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DYNAMICAL CAPTURE OF THE MOON BY THE EARTH
Raymond A. Lyttleton 15 Nov. 1966 20 p refs
(Contract NAS7-100)
(NASA-CR-79456; JPL-TR-32-1020) CFSTI: HC $1.00/MF $0.50 CSCL 03C

Numerical integrations of dynamical equations relating to the Sun, Earth, and Moon have been carried out to determine conditions under which the Moon could be temporarily captured from an independent planetary orbit to become an Earth satellite. The period of time 2T for which it would remain captured depends critically on the solar eccentricity, and on the major-axis and eccentricity of the lunar orbit. This orbit becomes unstable, in the sense that the Moon would eventually escape, if either a or e is increased beyond certain limits. The dependence of T on the initial values of a and e is shown in diagrams, as also are the paths of the Moon relative to the Sun and relative to the Earth in its motion of escape. Possible sources of dissipative action that could render such temporary dynamical capture permanent are briefly discussed. Author

N67-10787*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE DEVELOPMENT OF A MATHEMATICAL MODEL AND A STUDY OF ONE METHOD OF ORBIT ADJUST AND STATION KEEPING GRAVITY-ORIENTED SATELLITES
Curtiss C. Barrett Washington, NASA, Nov. 1966 55 p refs
(NASA-TN-D-3652) CFSTI: HC $2.50/MF $0.50 CSCL 22C

The differential equations of motion for a coupled two-body, gravity-oriented, satellite are derived. Each of the two bodies is assumed to be rigid. The satellite configuration is basically an x with a damper rod attached so that it is free to move constrained only by a spring damper mechanism in a plane fixed with respect to the x plane. This leads to a seven degree-of-freedom problem. A Fortran II digital program is included to provide a numerical solution for these equations. One method of orbit adjust and station keeping is studied. The satellite parameters are chosen for a medium altitude orbit. A one pound thrust level and a misalignment angle of one degree are assumed for the station keeping thrusters. The results of the study show that a 0.01 orbit eccentricity change can be made in 40 days with tangential pulses of 40 seconds duration every 22.4 hours without causing satellite inversion. Author

N67-10791*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF THE KRYLOV–BOGOLUBOV METHOD TO SOLUTION OF THE STELLAR THREE-BODY PROBLEM
Peter Musen Washington, NASA, Nov. 1966 38 p refs
(NASA-TN-D-3710) CFSTI: HC $2.00/MF $0.50 CSCL 03C

The motion in a ternary system consisting of a central body, A, close companion B, and distant companion, C, is considered and the perturbations of B due to C are determined. The osculating orbit of B relative to A can be an eccentric ellipse, not extremely elongated, and the orbit of C around the center of mass of A and B is a fixed ellipse which might have a large eccentricity, e'. The mutual inclination of the orbits of B and C can also be large. The solution pursued here is a development of perturbations into trigonometric series with arguments linear in f' and similar in form to the standard arguments of the lunar theory. To this end we consider the squares of λ, of the parallax, and of the mean eccentricity of B as small parameters. The problem is solved by applying the Krylov–Bogolubov method to eliminate the significant short-period effects from the Milankovich differential equations for the general perturbations of the Laplacian vector $\vec{e}$ and the areal velocity $\vec{c}$. Thus, the elements which are affected only by the long period perturbations must then be established. Author

N67-10798*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
STELLAR EVOLUTION I: CALIBRATION OF THE HERTZSPRUNG-RUSSELL DIAGRAM IN TERMS OF AGE AND MASS FOR MAIN-SEQUENCE B AND A STARS
T. Kelsall and Bengt Stroemgren (Inst. for Advanced Study) Washington, NASA, Nov. 1966 26 p refs
(NASA-TN-D-3720) CFSTI: HC $1.00/MF $0.50 CSCL 03A

On the basis of improved values of the energy-generation function and the opacity function that have become available in recent years, evolutionary model sequences of main-sequence stars for the mass range $\log M/M_{\odot} = -0.20$ to 0.85 have been computed. The calibration of the Hertzsprung-Russell diagram, in terms of age and mass for main-sequence B and A stars, presented in this paper was derived from the results of these evolutionary model sequence calculations. Author

N67-10797*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON SOME POSSIBLE MODIFICATIONS IN BROUWER'S THEORY OF THE GENERAL PERTURBATIONS IN RECTANGULAR COORDINATES
Peter Musen Washington, NASA, Nov. 1966 21 p refs
(NASA-TN-D-3721) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The method of general perturbations in rectangular coordinates is the most direct of all methods of expansion of the perturbations into series, because it is intimately associated with the computation of ephemerides. In addition, unlike the method of variation of elliptic elements, the method of coordinates does not have the zero eccentricity as a singularity. Brouwer's theory of the general perturbations in the rectangular coordinates makes use of the variation of elements in the canonical form. However, if the perturbations are being developed into trigonometric series with purely numerical coefficients, the use of canonical elements is not of any advantage. Davis' formula contains two terms of order -1 in the eccentricity. The presence of these terms causes considerable numerical inconvenience in the case of nearly circular orbits. We suggest here use of the Ecker-Brouwer formula for the orbit correction as a foundation of a planetary theory. The application of this formula leads directly to a vectorial expression for perturbations which is free from the disadvantages mentioned above and is also convenient for the numerical computations. Author

N67-10864*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
OPTICAL ASTRONOMY PACKAGE FEASIBILITY STUDY FOR APOLLO APPLICATIONS PROGRAM Executive Summary Report
E. H. Wells 5 Aug. 1966 19 p
(NASA-TM-X-53496) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The feasibility of adapting the Goddard Experiment Package, developed for the Orbiting Astronomical Observatory, to Apollo missions on the lunar surface is investigated. Full consideration is given to an entire mission utilizing typical astronomical experiments. Data is provided to assist in program planning of lunar surface optical astronomy missions and equipment. Evolutionary growth potentials were considered and all indications were that a 5- to 6-year period is realistic for the time required from initiation of the project to flight. Author

N67-10872*# California Univ., Berkeley. Space Sciences Lab.
ABSTRACTS OF RESEARCH PROJECTS ON THE BERKELEY CAMPUS
Samuel Silver 28 Oct. 1966 87 p Presented at the Space Sci. Symp., Berkeley, Calif., 28 Oct. 1966
(Grant NsG-243)
(NASA-CR-79716) CFSTI: HC $3.00/MF $0.75 CSCL 03B

Abstracts are presented of NASA contracts and grants in the fields of planetary physics, exobiology, space physics, and physiological problems. Also included are data from studies on management science and decision making, information processing, and engineering sciences. A.G.O.

N67-10877*# California Univ., Berkeley. Space Sciences Lab.
THE INFLUENCE OF TOPOGRAPHY ON THE FORMATION OF TEMPORARY BRIGHT PATCHES ON MARS
B. T. O'Leary and D. G. Rea 1966 17 p refs
(Contract NASr-220; Grant NsG-101-61)
(NASA-CR-79721) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The Mountains of Mitchel and other temporary bright patches observed on the Martian disk have been previously interpreted as elevated areas where H_2O-ice has formed. However, a calculation of the radiation balance on Mars and the observed duration of the Mountains of Mitchel suggest that they are CO_2 condensations in depressions with depths of ~6 to 9 km. The appearance of bright spots on Hellas and other areas in the southern hemisphere can also be explained by depressions where the minimum nighttime temperature is low enough for CO_2 to condense. The possibility of H_2O condensation in depressions is also discussed. These results support the hypothesis that the Martian deserts are lower than their surroundings. Author

N67-10880*# IIT Research Inst., Chicago, Ill. Astro Sciences Center.
SCIENTIFIC OBJECTIVES OF DEEP SPACE INVESTIGATIONS. THE ORIGIN AND EVOLUTION OF THE SOLAR SYSTEM
J. M. Witting Sep. 1966 121 p refs
(Contract NASr-65(06))
(NASA-CR-79724; P-18) CFSTI: HC $4.00/MF $0.75 CSCL 03B

Spacecraft measurements related to the study of solar system origin and evolution are examined. Boundary conditions, facts that must be explained by any complete theory, are enumerated. Three classes of theories are listed: catastrophic theories postulating a Sun-star encounter, evolutionary theories proposing formation of the solar system out of a single contracting cloud of interstellar material, and mixed theories postulating a Sun-interstellar cloud encounter. Future work of highest importance is listed as measurements of interstellar composition, including isotopic ratios, on a mission to solar system escape and measurements of isotopic ratios on a Jovian planet or a comet. S.P.

N67-10892*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
ANALOG STUDIES OF THE LIMIT-CYCLE FUEL COMSUMPTION OF A SPINNING SYMMETRIC DRAG-FREE SATELLITE
Robert Farquhar May 1966 48 p refs
(Grant NsG-582)
(NASA-CR-79709; SUDAAR-276) CFSTI: HC $2.00/MF $0.50 CSCL 22A

In the analog computer simulation, the limit-cycle fuel consumption rate was used as a performance criterion for comparing an on–off control versus a pulse width, pulse frequency system. A lead lag filter was used to derive rate information from the position measurements; noise was added to these measurements, and its effect on performance is also considered. Results indicate that the pulse width, pulse frequency control system has superior noise rejection characteristics and is more economical even without noise inputs. The simulation also showed that both control systems automatically commutate the jets fixed on the rotating vehicle so that they fire to oppose the drag force; the exception is a small control component perpendicular to the drag direction which stabilizes the cross-axis motion. It was also found that the control systems do not require measurements of the magnitude or direction of the drag force. M.G.J.

N67-10965# RAND Corp., Santa Monica, Calif.
IMPLICATIONS OF MANEUVERING-RANGE CONSTRAINTS ON LIFTING-VEHICLE DESIGN
Johann Lau Jul. 1966 28 p refs
(P-3424; AD-638448) CFSTI: HC $2.00/MF $0.50

The effects of decreases in the maneuvering range angle on the design parameters for a lifting maneuverable spacecraft performing orbital plane changes aerodynamically are investigated. The design parameters considered here are the velocity or propulsion requirements, the heat transfer, accelerations, and total time of flight for the maneuver. The results indicate that these parameters become more critical as the maneuvering range decreases. Specified limits on these design parameters and constraints on the maneuvering range decreases. Specified limits on these design parameters and constraints on the maneuvering range can be superimposed graphically on a single chart, thus defining an allowable

maneuvering region. The high heating rates resulting from small-range-angle maneuvers severely restrict the extent of the maneuverability evelope. In order to extend the maneuvering capabilities for small range angles, the vehicle must be designed for high propellant capacity, high g-loading, and sophisticated heat-protection systems. Author (TAB)

N67-11009# Boeing Scientific Research Labs., Seattle, Wash.
TRANSIENT RADIATIVE HEAT EXCHANGE AT THE SURFACE OF THE MOON
D. F. Winter Aug. 1966 26 p refs
(D-82-0559; AD-639051) CFSTI: HC $2.00/MF $0.50

The surface of the Moon is characterized as an evacuated particulate medium in which radiative heat exchange between solid surfaces plays a decisive role in determining the transient behavior of the apparent temperature. A simple model is developed which permits quantitative comparisons with lunar surface temperature variations, observed in the 8-12 micron band, both during a lunation and a lunar eclipse. Thermal properties and certain surface characteristics are thereby inferred, including an effective microstructure scale of the order of 0.1 mm Author (TAB)

N67-11063# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF THIRD AND FIFTH HARMONICS IN THE DECOMPOSITION OF POWER GRAVITATIONAL FORCE OF A PLANET ON THE MOVEMENT OF ITS SATELLITES
A. A. Orlov 6 Jun. 1966 16 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. III: Fiz., Astron. (Moscow), no. 6, 1964 p 80–88
(FTD-TT-65-872; TT-66-62329; AD-639424) CFSTI: HC $1.00/MF $0.50

Formulas were obtained for the representation of first order relative to Q_3 and Q_5 in expressions of coordinates of a satellite of a nonspherical planet. When deriving these formulas, the decomposition into series by degrees of inclination-eccentricities of imperturbed orbits was not used. The final result is presented in form of sums of members of two forms: (a) periodic members, depending only upon sinuses and cosinuses of various multiplicity factors, and (b) mixed members, equal to the product of periodic members on an imperturbed actual anomaly v. Author (TAB)

N67-11110*# Volt Technical Corp., Washington, D. C.
PRELIMINARY RESULTS OF INVESTIGATION OF SOLID INTERPLANETARY MATTER IN THE VICINITY OF THE MOON [PREDVARITEL'NYYE RESUL'TATY ISSLEDOVANIYA TVERDOGO MEZHLANETNOGO VESHCHESTVA V OKRESNOSTI LUNY]
T. N. Nazarova, A. K. Rybakov, and G. D. Komissarov 28 Oct. 1966 5 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 170, no. 3, 1966 p 578–579
(Contract NAS5-12487)
(NASA-CR-79831; ST-IM-LPS-10531) CFSTI: HC $1.00/MF $0.50 CSCL 03B

Density of the matter in the vicinity of the moon is found to average at least four orders more than that of matter in interplanetary space, according to instrumentation with piezoelectric sensors aboard Luna-10. The observations were made in a sheath of about 650 km thickness surrounding the moon; and the registered particles, seen at heights from 355 to 1050 km, were agglomerated predominately in clusters of extension from ~100 to ~900 km. No dependence of spatial density of particles on distance from the moon was seen. M.W.R.

N67-11134# Joint Publications Research Service, Washington, D. C.
THE BYURAKANSKAYA ASTROPHYSICAL OBSERVATORY
V. A. Ambartsumyan 3 Nov. 1966 10 p Transl. into ENGLISH from Priroda (Moscow), Jul. 1966 p 41–49
(JPRS-38477; TT-66-34902) CFSTI: $1.00

A discussion is presented of the location of, the equipment for, and some of the observations made from the Byurakanskya Astrophysical Observatory. The basic area of research in the Observatory is the study of the structure of our galaxy and the study of the metagalaxy. Some observations are discussed which support the conclusion that the formation of stars in our galaxy is continuing even in our time, and that the formation of these stars takes place through groupings. A summary is also provided of studies of galaxies and their nuclei. H.S.W.

N67-11165# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIQUE PHOTO TAKEN OF THE MOON IN EARTHSHINE WITH THE ZENITY-S CAMERA
13 Jun. 1966 5 p Transl. into ENGLISH from Izv. (Moscow), 3 Jun. 1964 p 4
(FTD-HT-66-119; TT-66-62284; AD-639156) CFSTI: HC $1.00/MF $0.50

A brief, journalistic account is given of a successful attempt to photograph the lunar disk by earthshine. The exposures were made at high altitude in North Pimar. Photometric scanning of the plates revealed that certain areas of the lunar surface, situated in the eastern and northeastern extremes, have an increased brightness under earthshine. TAB

N67-11168# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRUTH (SELECTED ARTICLES)
15 Jun. 1966 12 p Transl. into ENGLISH from Pravda (Moscow), 1 Jan. 1966 p 4
(FTD-HT-66-226; TT-66-62356; AD-639495) CFSTI: HC $1.00/MF $0.50

Translation of two Russian articles on space flight: steps into the future; on the way to the planet venus. TAB

N67-11169# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A NEW EPOCH IN PERCEPTION OF THE UNIVERSE
M. V. Keloysh and A. I. Lebdinskiy 15 Jun. 1966 10 p Transl. into ENGLISH from Pravda (Moscow), 11 Feb. 1966 p 1–3
(FTD-HT-66-227; TT-66-62339; AD-639441) CFSTI: HC $1.00/MF $0.50

A press conference on Luna 9 investigations and other space accomplishments is presented. TAB

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N67-10063*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INTRODUCTION
L. D. Jaffe and S. E. Dwornik *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 3–6 ref (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

Mission objectives, equipment, configuration, trajectory, landing site, and landing operation are briefly summarized. Details are given of the TV camera, picture transmission, and camera operations. K.W.

N67-10065*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR SURFACE THERMAL CHARACTERISTICS
J. W. Lucas, J. E. Conel, R. R. Garipay, W. A. Hagemeyer, and J. M. Saari *In its* Surveyor I Mission Rept., Part II 10 Sep. 1966 p 45–59 refs (See N67-10061 01-30) CFSTI: HC $4.00/MF $0.75

Although the spacecraft carried no instruments, as such, to measure thermal characteristics, the temperatures of the outer surfaces of two electronic compartments were highly dependent on the local thermal radiation environment and largely independent of internal spacecraft temperatures. These spacecraft temperatures were used to estimate the average brightness temperature of those portions of the surface viewed by each compartment. A summary is given of pertinent terrestrial infrared and photometric observations of the Surveyor I site. The procedures used to arrive at surface temperatures are described in detail. A comparison is presented of Surveyor I data and theory. The article concludes with a discussion of dust coverage of the spacecraft from a thermal standpoint. K.W.

N67-10079# Royal Aircraft Establishment, Farnborough (England).
THE ORBIT OF INJUN 3 ROCKET (1962 $\beta\tau$ 6) FOR 1963 TO 1965
Diana W. Scott Jun. 1966 20 p refs
(RAE-TR-66196) CFSTI: HC $1.00/MF $0.50

Orbital parameters of Injun 3 rocket have been determined from over 300 visual and kinetheodolite observations during four periods of a week or more in August 1963, May 1964, April and October 1965. The main object of the orbital determination was to provide information for studying the rotation of the upper atmosphere. The accuracy of 12 observing stations has been assessed from declination residuals; the rms values obtained are within the observers' own estimates, and the best visual observers have an average error, in good conditions, of about 1', which compares well with the average of about 1/2' for kinetheodolite observations. Author

N67-10202*# National Aeronautics and Space Administration, Washington, D. C.
IN OPEN SPACE–VOSKHOD-2 SPACECRAFT DESIGN [V OTKRYTOM KOSMOSE–USTROYSTVO KORABLYA "VOSKHOD-2"]
D. Viktorov Jun. 1966 10 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), v. 48, 1965 p 17–19
(NASA-TT-F-10216) CFSTI: HC $1.00/MF $0.50 CSCL 22B

Abridged versions of two official documents issued by the USSR Federation of Aviation Sports in connection with the orbital flight of the Soviet cosmonauts Belyayev and Leonov on Mar. 18, 1965 are presented. The documents are (1) a statement on the maximum distance of movements of Leonov outside the spacecraft, and (2) a report containing a comprehensive description of the design, instrumentation, and operation of the spacecraft (Voskhod-2). Author

N67-10565# Academy of Sciences (USSR), Moscow. Astronomical Council.
OBSERVATION RESULTS OF SOVIET ARTIFICIAL EARTH SATELLITES, NO. 77
Mar. 1965 37 p In RUSSIAN CFSTI: HC $2.00/MF $0.50

Equatorial and horizontal coordinate data, compiled from visual tracking data and preliminary reduction of photographic tracking data, is presented in tabular form for the Cosmos XI, Cosmos XVII, Cosmos XIX, Polet I, Cosmos XXIII, and Elektron I satellites for February 1964. L.E.W.

N67-10566# Academy of Sciences (USSR), Moscow. Astronomical Council.
OBSERVATION RESULTS OF SOVIET ARTIFICIAL EARTH SATELLITES, NO. 75
Mar. 1965 69 p In RUSSIAN
CFSTI: HC $3.00/MF $0.75

Tables are presented containing the equatorial and horizontal coordinates of the Soviet satellites Sputnik, Cosmos XI, Cosmox XVII, Cosmos XIX, and Polet I for the months of October, November, and December 1963. L.E.W.

N67-10567# Academy of Sciences (USSR), Moscow. Astronomical Council.
OBSERVATION RESULTS OF SOVIET ARTIFICIAL EARTH SATELLITES, NO. 76
Mar. 1965 33 p In RUSSIAN and ENGLISH CFSTI: HC $2.00/MF $0.50

Visual tracking and photographic tracking data on the equatorial and horizontal coordinates of Soviet satellite for January, 1964 are presented in tabular form. The satellites considered include Cosmos XI, Cosmos XVII, Cosmos XIX, Polet I, Cosmos XXIII, and Cosmos XXIV. L.E.W.

N67-10743*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARS ENTRY AND LANDING CAPSULE
W. J. Carley 1 Jul. 1965 85 p refs
(Contract NAS7-100)
(NASA-CR-79576; JPL-TM-33-236) CFSTI: HC $2.50/MF $0.75 CSCL 22B

The problems involved in delivering an Apollo-type entry capsule to Mars, entering and descending through its atmosphere, and placing a scientific payload on its surface are probed in some depth. Results indicating the feasibility and complexity of various approaches to this mission are given. Author

N67-10786*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
LANDING CHARACTERISTICS OF A DYNAMIC MODEL OF THE HL-10 MANNED LIFTING ENTRY VEHICLE
Sandy M. Stubbs Washington, NASA, Nov. 1966 57 p ref Film supplement number L-916 to this report is available on loan from Langley Res. Center
(NASA-TN-D-3570) CFSTI: HC $2.50/MF $0.50 CSCL 22B

Several tricycle landing-gear configurations, all of which used two main rear skids with variations in the nose gear, were investigated to determine landing accelerations and slideout stability for horizontal type landings. Techniques for counteracting side wind or sloping (crowned) runway forces which might cause the spacecraft to slide off the runway were also investigated. A free-swiveling nose-wheel configuration, with and without a roll-steering system, a torque-steering configuration, and a nose-skid configuration were investigated for landing conditions consistent with the winged entry type spacecraft. A basic configuration without a landing gear was investigated to determine its accelerations and stability in a skid-rocker (belly) type landing. The vehicle was landed on a runway landing surface with and without a braking parachute. Calm-water landings were investigated in both horizontal (aircraft type) and vertical (parachute type) landing modes. Parachute type landings were also made in waves. Results indicate that the vehicle with the tricycle landing-gear configurations, using either the free-swiveling nose wheel or the nose-skid configuration has good tracking characteristics for landings without the presence of a side wind or a crowned runway. Author

N67-10865*# National Aeronautics and Space Administration, Washington, D. C.
GEMINI PICTORIAL
Repr. from NASA Facts, v. 4, no. 1, Oct. 1966 12 p
CFSTI: HC $1.00/MF $0.50

Various phases of the Gemini space flights are presented pictorially, and a narrative account briefly summarizes the history, goals, achievements, and cost of the Gemini program. The photographs illustrate the spacecraft, views of the earth from the spacecraft, extravehicular activities of the astronauts, and splashdown. L.E.W.

N67-10866*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THERMAL PROTECTION SYSTEM FOR A CRYOGENIC SPACECRAFT PROPULSION MODULE, VOLUME I Final Report

W. H. Sterbentz and J. W. Baxter 15 Nov. 1966 20 p
(Contract NAS3-4199)
(NASA-CR-54879; LMSC-A79493, Vol. I) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The primary objective of the research was the development of a lightweight insulation that would limit liquid hydrogen boiloff to less than 5% of the initial propellant load during an eight day lunar mission. This objective, as well as other program objectives, was achieved. An optimum thermal protection system based on reflective multilayered insulation materials for the liquid hydrogen propellant tank of the cryogenic propulsion module was designed. The insulation system selected consists of a helium purged Fiberglass batting substrate for ground-hold insulation, overlaid with 36 layers of double aluminized 0.25 mil Mylar, separated by 2.8 mil Dexiglas paper. It is assembled in buttoned, modular panels. The support structure required to suspend the liquid hydrogen tank within the load-carrying outer shell of the vehicle was also designed. Photographs and drawings of the thermal protection system are included. H.S.W.

N67-10867*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
THERMAL PROTECTION SYSTEM FOR A CRYOGENIC SPACECRAFT PROPULSION MODULE, VOLUME II Final Report
W. H. Sterbentz and J. W. Baxter 15 Nov. 1966 520 p refs
(Contract NAS3-4199)
(NASA-CR-54879; LMSC-A794993, Vol. II) CFSTI: HC $5.69/MF $2.25 CSCL 22B

Details of the technical effort are presented. Graphs, curves and data tables, drawings, analyses, and evaluations are discussed. Information is given on the insulation systems design, tank structural support design, component and subscale model tests, half scale test module fabrication, half scale model tests, and full scale system design and fabrication specifications. A post test analysis of the test data was made. The conclusions drawn from this analysis and the recommended design changes are listed. H.S.W.

N67-10868*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.
AN EQUILIBRIUM STATE FOR THE INTERSTELLAR GAS AND MAGNETIC FIELD
I. Lerche Oct. 1966 26 p refs
(Grant NsG-96-60)
(NASA-CR-79749; EFINS-66-92) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A simple periodic system is set up to demonstrate that the interstellar gas-magnetic field system, which has been shown to be unstable to a Rayleigh-Taylor perturbation, can form an equilibrium state in which the interstellar gas is clumped discretely. It is demonstrated that in at least one instance the total energy of the clumped system is less than the total energy in the original atmosphere. It is believed that the results should be true for a much wider class of situation than the simple system for which we have been able to perform the mathematics. Author

N67-10876*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
DEVELOPMENT OF PROGRAMMED ASSISTANCE IN DIRECTING STRUCTURES RESEARCH
J. A. Boddy and J. C. Mitchell Jun. 1966 385 p refs
(Contract NAS7-368)
(NASA-CR-79720; SID-66-408) CFSTI: HC $7.00/MF $1.75 CSCL 22D

Utilization of existing automated analytical techniques to determine significant structures/materials research areas in current and predicted expendable launch vehicle systems is discussed. The vehicle sizing programs used operational modes to achieve minimum vehicle lift-off weight for new vehicle systems and to achieve maximum vehicle payload weight for modified existing vehicles systems. Structural and material improvements were judged most beneficial with respect to component weight reduced, equivalent payload gained, and economy. S.P.

N67-10975# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TRACKING A SPACESHIP
6 Apr. 1966 24 p Transl. into ENGLISH from Aero-Space (E. Germany), no. 9, 1965 p 290–297
(FTD-TT-65-1706; TT-66-62231; AD-638881) CFSTI: HC $1.00/MF $0.50

Discussion of the design and performance of the Russian Vostok spacecraft. TAB

N67-11130# Aracon Geophysics Co., Concord, Mass.
APT STATION OPERATION, PART X
Jan. 1966 27 p

An outline is presented for the automatic picture taking (APT) subsystem station operation for the local reception of direct readouts of both APT television and of high-resolution infrared facsimile pictures. Plans for evaluation of Nimbus C APT/direct readout infrared and the APT data code experiment are also described. S.P.

N67-11173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LUNA-9 AT THE EXHIBITION OF ECONOMIC ACHIEVEMENTS OF THE USSR
K. Tolkachev 31 Aug. 1966 5 p Transl. into ENGLISH from Pravda. (Moscow), 28 Mar. 1966 p 6
(FTD-HT-66-345; TT-66-62226; AD-638876) CFSTI: HC $1.00/MF $0.50

Translation of Russian article: Luna-9 at the exhibition of Economic Achievements of the USSR. TAB

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N67-10045# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLUTTER OF A CYLINDRICAL SHELL LOCATED UNDER THE ACTION OF HIGH TEMPERATURES
S. A. Ambartsumyan and G. E. Bagdasaryan *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 49–58 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

A circular cylindrical shell of infinite length with a supersonic gas flow of constant velocity directed along the shell is discussed. Expressions are developed for the relationship of the modulus of elasticity of the shell and the temperature, and the temperature variation in time. The results are extended for the case of an infinite plate. N.E.N.

N67-10046# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DEVELOPMENT AND INTERACTION OF PLASTIC-ELASTIC WAVE LOADS IN A ROD OF FINITE LENGTH
G. V. Litvinov *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 59–67 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

An analytical solution using the approximation method is presented for the problem of shock wave longitudinal loading of a rod with one end fixed and the other suddenly set into constant motion. Different methods of plotting the approximation are mentioned. Expressions are developed for the motion of the finite rod, and illustrations are included of the solutions for the simple wave, the region of interaction, and the regions following the interactions. N.E.N.

N67-10047# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STABILITY OF A CYLINDRICAL SHELL WITH AN INTERNAL LIQUID UNDER GAS FLOW
Yu. Yu. Shveiko *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 68–78 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

Calculations for minimum critical flutter velocities for an enclosed circular shell are discussed. It was assumed that the shell was under a supersonic flow of compressible gas with a constant velocity, that there is an absolutely stiff flat lateral diaphragm on the lower face of the shell, and that the shell is filled to a given depth with an ideal liquid. The problem was solved by expansion of functions conforming with given boundary conditions and a variation method. The case limited by the minimum critical flutter velocities for a completely filled shell were investigated, and several simplified approaches were considered. N.E.N.

N67-10074# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE DYNAMIC STABILITY CRITERION FOR SHALLOW SHELLS OF REVOLUTION
L. I. Shkutin [1964] 6 p refs Transl. into ENGLISH from Teoriia Obolockek i Plastin (Erevan), no. 4, 1964 p 1008–1013 CFSTI: HC $1.00/MF $0.50

A simple criterion in the form $K_{\max} = \max(\Pi)$ (where $K_{\max}$ is the kinetic energy of the least primary impulse causing snapping of a shell, and Π the strain potential energy of the shell) was previously used to determine critical values of the impulse for a shallow spherical dome and a long cylindrical panel for a particular kind of condition on their edges. The solution is generalized here to the case of a solid shallow shell of revolution with a meridian in the form of a power function and arbitrary elastic framing of the edge. Numerical computations were carried out for conical and spherical shells for the following boundary conditions: (1) fixed edge; (2) freely supported edge; (3) framed edge; and (4) rigidly supported edge. It was observed that the constraint on the radial displacement of the edge causes a significant increase in the critical value of the delivered kinetic energy. K.W.

N67-10153# National Aerospace Lab., Tokyo (Japan).
THE SHAPE OF MECHANICAL HYSTERESIS LOOP, ITS DEFORMATION DUE TO STRESS REPETITION AND RESULTING INCREASE IN FLOW STRESS. PART 1: EXPERIMENT. PART 2: THEORY FOR TORSION
Fujio Nakanishi, Yasuo Sato, and Fumio Nagai Jun. 1966 27 p refs
(NAL-TR-90T) CFSTI: HC $2.00/MF $0.50

Experimental results of the hysteresis loops during repeated torsion, pure shear and tension are presented in this paper. The following observations are made: (1) The stress-strain relations in reloading and unloading are symmetric. (2) The hysteresis loop is composed of several sections. For instance, the reloading or unloading curve in torsion has three straight sections and shows bends at stresses of one third and two thirds of the flow stress. (3) The beginning section of reloading curve is elastic while the slopes of the other lines vary as the stress is repeated, thus resulting in a change in the shape of the loop. (4) The stress repetition produces an increase in the stress for the commencement of plastic flow, but this effect vanishes as the plastic flow is continued. Author

N67-10199*# National Aeronautics and Space Administration, Washington, D. C.
THE STABILITY OF ORTHOTROPIC CYLINDRICAL SHELLS [USTOYCHIVOST' ORTOTROPNYKH TSILINDRICHESKIKH OBOLOCHEK]
O. N. Len'ko Jul. 1963 45 p refs Transl. into ENGLISH from Raschet Prostranstvennykh Konstrukt. (Moscow), issue IV, 1958 p 499–524
(NASA-TT-F-9826) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A study of the stability of open circular cylindrical shells (panels) subjected to compression along the generator is presented. It is assumed that the shell is orthotropic. This is the case with closely spaced longitudinal and lateral stiffeners if they are considered to be "spread" over the entire surface of the shell. The closer the stiffeners are spaced, the more accurate this assumption will be. Structures also make use of shells of materials having anisotropic elastic properties (for example, plywood, plastics, reinforced materials, sandwich skins, etc.), which may be considered to be orthotropic. The article considers the stability of the panel "in the large": the buckling deflections are considered to be comparable to the thickness of the shell. This leads to the consideration of the nonlinear problem and the associated complex solution. However, this complexity is unavoidable; we know that the solutions of the problem of the stability of shells "in the small", based on linear theory, are not confirmed experimentally. Author

N67-10208*# National Aeronautics and Space Administration, Washington, D. C.
DESIGN OF PINNED BLASES FOR VIBRATION [RASCHET NA KOLEBANIYA SHARNIRNYKH LOPATOK]
B. F. Shorr Sep. 1966 37 p refs Transl. into ENGLISH from the book "Prochnost' i Dinamika Aviatsionnykh Dvigateley" USSR, Izd. Mashinostr., 1965 p 292–315
(NASA-TT-F-10273) CFSTI: HC $2.00/MF $0.50 CSCL 20K

Development of a general method for calculating the vibrations of twisted pinned blades under combined bending and torsion. The analysis extends previous results obtained for rigid blades. Author

N67-10219*# National Aeronautics and Space Administration, Washington, D. C.
STRESS–STRAIN RELATIONS IN LAMINAR MEDIA [ZAVISIMOSTI MEZHDU NAPRYAZHENIYAMI I DEFORMATSIYAMI V SLOISTYKH SREDAKH]
L. P. Khoroshun Oct. 1966 9 p refs Transl. into ENGLISH from Prikl. Mekh. (USSR), v. 2, no. 2, 1966 p 14–19
(NASA-TT-F-10316) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Derivation of stress–strain relations are presented for a laminar anisotropic medium from the known mechanical properties of the layers. Expressions are obtained for determining the stresses and strains in the individual layers from the known average values of the stresses and strains. The cases are examined in which the layers are elastic isotropic. The results are applied to the calculation of the mechanical characteristics of several fiber-reinforced plastics. Author

N67-10337# Army Materials Research Agency, Watertown, Mass.
THE SHORT SINGLE EDGE CRACK SPECIMEN WITH LINEARLY VARYING END DISPLACEMENTS
Joseph M. Bloom Jul. 1966 13 p refs
(AMRA-TR-66-21; AD-638170) CFSTI: HC $1.00/MF $0.50

Stress intensity factors for single edge cracks in square sheets with prescribed linearly varying end displacements are investigated. The stress distribution around the crack tip is reduced to the solution of a Riemann-Hilbert problem. Numerical results are presented for several crack lengths in a square sheet Author (TAB)

N67-10351# Naval Civil Engineering Lab., Port Hueneme, Calif.
STATIC AND DYNAMIC BEHAVIOR OF ANTISYMMETRICALLY LOADED ARCHES Technical Report, 6 Feb. 1961–1 Sep. 1965
R. H. Chiv and S. K. Takahashi Sep. 1966 151 p refs
Sponsored by DASA
(R-474; AD-638316) CFSTI: HC $5.00/MF $1.00

Four pinned-base steel arches with a 96-inch radius, 143.8-inch span, and uniform cross section were cold-rolled from 4M13 sections and tested under various static and dynamic loads uniformly distributed over one-half the arc length. A maximum static load of 72,000 pounds was applied by the NCEL blast simulator using compressed air. A dynamic peak load of 64,000 pounds was attained by detonating Primacord in the blast simulator. The blast loading had a rise time of about 3 milliseconds and a decay time of about 1.6 seconds. An equivalent triangular load-time function was used for the dynamic analysis. The applied loads and the resulting deflections, strains, and reactions were measured. The reduced data are presented in graphical and tabular form. The theoretical analyses for statically and dynamically loaded arches were based on the discrete framework which represented the continuous arches tested. A 16-bar system was used for both static and dynamic response calculations, and a 40-bar system was used for natural mode and frequency calculations. In the static analysis, the effects of stress amplification, misalignment, and elastic supports on the response of the arch were considered. Due to the strain-hardening characteristics of the arch material, the idealized stress-strain curve was represented by a trilinear curve rather than by the usual bilinear stress-strain curve. A simplified dynamic analysis gave results reasonably close to those from more rigorous methods; the values were on the conservative side. Nearly complete correlation between the theoretical and experimental results was obtained Author (TAB)

N67-10364# Marine Engineering Lab., Annapolis, Md.
VIBRATION TRANSMISSION OF FLEXIBLE PIPE COUPLINGS INFLUENCED BY THE ELEMENTS OF A TRIM-PUMP SYSTEM
Ronald C. Hirsch Sep. 1966 53 p refs
(MEL-263/66; AD-638501) CFSTI: HC $3.00/MF $0.50

An analytical-experimental study was performed to determine the sound transmission characteristics of a flexible coupling in a trim-pump system. Mechanical impedance methods were used to compare the structural path to the hull via resilient mounts and foundation to the structural path via flexible coupling and pipe hanger. Also investigated were the vibration characteristics of an Electric Boat and MEL flexible coupling under pressurized and unpressurized conditions. Results showed that the sound transmission via flexible coupling and pipe hanger exceeded the sound transmission via the mount and foundation and would negate the isolation effectiveness of the primary mounting system. The results of comparing the two types of flexible coupling showed that the Electric Boat Coupling exhibited better total noise attenuation characteristics than did the MEL coupling. However, the MEL coupling showed a unique inherent characteristic of improved attenuation capabilities with increased pressure loading.
Author (TAB)

N67-10436# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
UNSYMMETRIC ANALYSIS OF SHELLS OF REVOLUTION
Robert Rung, Philip Mason, and Jacob Rosenbaum Dec. 1965 85 p refs
(ADR-02-11-65.3)

This report reviews a general theory for the non-linear analysis of such shells under unsymmetric loading. The theory is then used to formulate a digital computation system utilizing Fourier Series in the circumferential coordinate and numerical integration in the meridional direction. The procedure has been programmed with the aim of simple yet general input procedures and readily usable output data. While initially employed for the non-linear axisymmetric analysis of LEM pressure vessels, the program has since been applied to many varied structures–from hardware fittings to launch rocket shrouds. The scope of the method is indicated by several applications already made and several desirable refinements are indicated. Author

N67-10438# Tokyo Univ. (Japan).
THE BUCKLING OF SPHERICAL SHELLS BY EXTERNAL PRESSURE
Masuji Uemura [1954] 9 p refs In JAPANESE; ENGLISH Summary
(Rept.-4)

The lower buckling load of thin shells is connected with the elastic characteristics of loading structure. The following first two problems excluding the case of dead weight loading already treated in previous papers where the external pressure remains constant during buckling process, were analyzed from the energetic considerations. That is, (1) the buckling by incompressible fluid pressure and (2) the buckling of a partial spherical shell by compressible gas pressure, corresponding to the cases of perfectly rigid and arbitrary elastic loading machines respectively. Moreover, (3) the second-order solution of a spherical shell where the solid angle pertaining to the buckled portion is large together with the deflection, was analyzed from the equilibrium equation due to finite deformation theory using the first-order solution in the 1st report. And (4) as an application of "Durchschlag" phenomenon, experiments on the apparatus which automatically prevents the electric transformer from burning out, were performed. Author

N67-10444# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
UNSYMMETRIC NON-LINEAR FIRST ORDER ANALYSIS OF LAYERED ORTHOTROPIC SHELLS OF REVOLUTION
Neil Prince, Robert Rung, and Vytas Svalbonas May 1966 73 p refs
(ADR-02-11-66.2)

The previously developed theory which was for isotropic homogeneous shells was extended to the case of orthotropic layered shells. The theory is then used to formulate a digital computation system utilizing Fourier series in the circumferential coordinate and numerical integration in the meridional direction. The theory is being programmed with the aim of simple yet general input procedures and readily usable output data. Author

N67-10499# Naval Ordnance Lab., White Oak, Md. Air/Ground Explosions Div.
STRESSES IN SHALLOW GLASS DOMES WITH CONSTRAINED EDGES
James F. Proctor 28 Jun. 1966 65 p refs
(NOLTR-66-46; AD-638138) CFSTI: HC $3.00/MF $0.75

Stress-strain relations developed for rotationally symmetric bending and stretching of shallow segments of thin spherical shells are extended to evaluate the response of a glass dome with edge constraint to a uniformly applied load over a small circular area at the apex. Theoretically derived stress-strain curves for the constrained-edge case are compared with similar curves with experimental results from several static tests. Also the effects of degree of edge constraint and locad concentration are demonstrated and discussed. Author (TAB)

N67-10505# Naval Ordnance Lab., White Oak, Md.
BEHAVIOR OF A CLOSED END HOLLOW CYLINDER ACTED UPON BY EXTERNAL PRESSURE
Arnold E. Seigel and Victor C. D. Dawson 7 Jan. 1966 35 p refs
(NOLTR-66-69; Ballistics Res. Rept.-160; AD-638175) CFSTI: HC $2.00/MF $0.50

The equations for plastic flow in a cylinder subjected to external pressure are derived. The case where reverse yielding occurs is also considered. The derived equations give results that are very similar to those for internal pressure application
Author (TAB)

N67-10581# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.
NUMERICAL SOLUTIONS OF THE NONLINEAR AXISYMMETRIC EQUATIONS FOR SHELLS OF REVOLUTION
John F. Mescall May 1966 27 p refs
(AMRA-TR-66-11; AD-638418) CFSTI: HC $2.00/MF $0.50

A numerical procedure for the solution of the nonlinear equations governing the large axisymmetric deflections of thin shells of revolution is presented and applied both to the complete equations due to Reissner and to the simpler equations to which these reduce for small-finite angle changes. Global solutions extending into the postbuckled range are shown to be considerably more complicated than expected. The character of the global solution is also shown to be quite sensitive to boundary conditions imposed. A comparison of the results obtained from the complete equations and the small-finite deflection equations reveals a very close agreement through the entire load-deflection history
Author (TAB)

N67-10590# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
CALCULATION OF MECHANICAL STRESS IN COILS OF REVOLUTION USED FOR THE PRODUCTION OF INTENSE MAGNETIC FIELDS
B. Léon Jun. 1966 13 p refs Transl. into ENGLISH from Rev. Gen. Elec. (Paris), v. 73, no. 12, 1964 p 632–636
(AERE-TRANS-1056) HMSO: 2s 6d

The design of windings intended for the production of intense magnetic fields is governed by the stresses to which the materials will be subjected. The author describes a new method of calculating these stresses which leads to results similar to those obtained by other workers. To make the expressions more easily calculable with the aid of an electronic computer, the radial force is represented by a polynomial.
Author

N67-10597# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
THE RESPONSE OF MECHANICAL SYSTEMS TO COMBINED FORCE AND MOTION EXCITATION
Louis J. Pulgrano Feb. 1966 19 p refs
(ADN-06-16-66.1)

Equations are developed for determining the response of mechanical systems to excitations consisting of prescribed forces at some coordinates and prescribed motions at others. It is found that these equations can be cast into the same form as the more common force excitation equations, where they are amenable to familiar methods of solution and the use of existing computer programs.
Author

N67-10784*# Pittsburgh Univ., Pa.
UPPER AND LOWER BOUNDS FOR THE EIGENVALUES OF VIBRATING BEAMS WITH LINEARLY VARYING AXIAL LOAD
William M. Laird and Guy Fauconneau Washington, NASA, Nov. 1966 77 p refs
(Grant NsG-634)
(NASA-CR-653) CFSTI: HC $2.50/MF $0.75 CSCL 20K

Previous investigations have demonstrated the importance of the effect of linearly varying axial or in-plane loading on the vibration characteristics of beams and flat plates. It has already been established that the problem reduces to solving for the eigenvalues of a fourth order, variable coefficient differential equation that can not be solved in closed form. Beginning with a variational representation of the eigenvalue problem, methods are discussed by which both upper and lower bounds for the eigenvalues may be formed. The true eigenvalues may thus be estimated as being bracketed by the upper and lower bounds which are shown to approach each other. The bounds for the eigenvalues may also be estimated by averaging procedure which may or may not compare favorably with the true values depending on the values of the loading parameters. Finally, numerical values for upper bounds, lower bounds, and average lumped end-load eigenvalues are computed on an IBM 7090 computer.
Author

N67-10846# Denver Research Inst., Colo.
AXISYMMETRIC THERMOELASTIC PROBLEMS IN BISPHERICAL COORDINATES Final Report
John A. Weese 12 May 1966 76 p refs Prepared for Sandia Corp.
(Contract AT(11-1)-1092)
(DRI-3327; SC-CR-66-2057; Rept.-556-6605) CFSTI: HC $3.00/MF $0.75

Steady state, axisymmetric thermoelastic problems defined in the bispherical coordinate system are presented. The four basic types of probe problems treated are: (1) a half space containing a uniformly heated spherical cavity; (2) an infinite medium containing two heated spherical cavities of arbitrary size; (3) an eccentric, heated spherical shell; and (4) an infinite medium containing two, heated, spherical rigid liners of arbitrary size. An outline of the theoretical analysis, operating instructions for the computer programs developed, and extensive numerical results and a description of the stress distribution for each problem are included.
NSA

N67-10887*# Stanford Univ., Calif. Dept. of Materials Science.
THE STRESSES PRODUCED BY A SCREW DISLOCATION PILEUP AT A CIRCULAR INCLUSION OF FINITE RIGIDITY
D. M. Barnett and A. S. Tetelman Oct. 1966 49 p refs Submitted for Publication
(Grant NsG-622)
(NASA-CR-79742; SU-DMS-66-30; TR-4) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The method of continuously distributed dislocations is used to obtain the exact solution for the distribution of screw dislocations in a linear array of length L piled up against a circular inclusion of radius R and finite shear modulus. The solution presented is valid for $0 < G_2/G_1 < \infty$, where G_2 is the shear modulus of the inclusion and G_1 is the matrix shear modulus. The solution enables one to study simultaneously the effects of second phase size and rigidity upon N, the number of dislocations in the pileup, and upon the local stresses induced in the second phase. In the second phase close to the pileup tip it is shown that the local stresses vary as: (1) $(2L/\rho)^g$, when the inclusion diameter is much greater than the slip line length

$$(2)\quad \sqrt{\frac{L}{4R}}\left|\frac{4R}{\rho}\right|^g,$$

when the particle diameter is much less than the slip line length. ρ is the radial distance from the pileup tip, and g is a function only of the shear moduli ratio, G_2/G_1, with $0 < g < 1$.
Author

N67-10923# North American Aviation, Inc., Columbus, Ohio.
DEVELOPMENT PROGRAM FOR A STRUCTURAL FIBER GLASS AIRCRAFT COMPONENT Final Report, 1963–1964
Lloyd E. Hackman, Charles L. Stotler, and D. Gene Worthington Phila., Pa., Naval Air Eng. Center, Jun. 1966 358 p refs
(Contract N156-43596)
(NAEC-ASL-1097; AD-639319) CFSTI: HC $7.00/MF $1.75

The report contains information on a development program to determine the practicability of glassfiber reinforced plastic (GFRP) structures. Specifically, the program involved the design, development, fabrication, and evaluation of GFRP versions of horizontal stabilizers for the T-2A trainer airplane. The program consisted of four primary phases-material selection and processing

development, component design, component fabrication, and structural tests. Four metal stabilizers for the T-2A aircraft were procured and identical tests were performed on both the GFRP and metal stabilizers so that a comparison of the important structural factors could be made. The results of the program indicate that GFRP primary airframe structures are practicable when compared with metal structures, but that the structural reliability of these structures is low because of failure to obtain consistently adequate strength at bonded joints. Much more development work is required in design, fabrication techniques, and quality assurance procedures to improve reliability. Author (TAB)

N67-10933# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF RESIDUAL STRESSES IN STEEL WELDMENTS Final Report
Koichi Masubuchi and D. C. Martin Washington, NASA—NRC, Sep. 1966 109 p refs
(Contract NObs-92521)
(SSC-174; AD-639619) CFSTI: HC $4.00/MF $0.75

Experimental hydrogen-induced-cracking tests were made on 45 weldments in mild steel, hy-80 steel, a commercial high-strength structural steel, and SAE 4340 steel. Extensive cracks were found in weldments made in SAE 4340 steel (oil quenched and tempered at 500°F) after hydrogen charging for relatively short times. Systematic crack patterns that could be related to residual stress distributions were obtained on various complex weldments. When steels of lower strengths were used, longer charging time was required to produce cracks, and crack patterns were less pronounced. The hydrogen-induced-cracking technique does not seem to work on mild-steel weldments. It has been found that hydrogen-induced cracking is stress sensitive rather than plastic-strain sensitive. This has been proved by hydrogen-induced-cracking tests on mechanically stress-relieved specimens and press-fit specimens in which residual stresses were produced by purely elastic deformation. It was found that distributions of residual stresses in mild-steel and SAE 4340 steel weldments were quite similar despite the considerable differences in the yield strengths of the two base plates and the weld metals. This was proved in butt joints up to 38 inches long and complex welded structures. Author (TAB)

N67-10984# Texas Univ., Austin. Engineering Mechanics Research Lab.
STUDIES OF PLASTIC WAVE PROPAGATION Final Report
E. A. Ripperger and H. L. Plass, Jr. Aug. 1966 17 p refs
(Grant DA-ARO(D)-31-124-G189)
(EMRL-TR-1007; AROD-2998-6; AD-639187) CFSTI: HC $1.00/MF $0.50

The object was to find ways and means, experimental and analytical, of surmounting difficulties encountered in the analysis of longitudinal plastic wave propagation and, in the process, gaining a clearer understanding of the mechanics of plastic wave propagation in rods and bars. The greatest stumbling block in the path of further progress in plastic wave studies appears to be the lack of a constitutive relationship obtained without the necessity of prior assumptions regarding the nature of plastic wave propagation. The major effort in this investigation was devoted to the development of experimental techniques for providing data pertinent to the flow condition. These techniques, when developed, were used to obtain data from which a constitutive relationship was developed Author (TAB)

N67-11020# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MATRIX ANALYSIS OF AXISYMMETRIC SHELLS UNDER GENERAL LOADING
Cecil D. Wallace, Jr. (M.S. Thesis) May 1966 111 p
(GAM/MC/66B-7; AD-639448) CFSTI: HC $4.00/MF $0.75

This report presents a technique for analyzing axisymmetrical shell structures subjected to a general loading condition, using the Matrix Displacement Method. The structures are idealized by truncated conical shell elements and circular flat plate elements, joined together at nodal circles. Loads represented by a combination of Fourier series are applied to the nodal circles, and the behavior is calculated in terms of the displacements and distortions of these nodal circles. Deflections, stresses, and buckling loads may be determined. Since large deflections are likely to occur in thin shell structures, a correction to linear small deflection theory is introduced by way of a geometric stiffness matrix, which also may be used in stability studies. Temperature variations around the circumference and through the thickness of the shell are considered. A computer program to solve the equations presented is available in FORTRAN IV language for an IBM 7094 computer. The method is a fast, versatile, accurate, and relatively simple way to analyze axisymmetric shells Author (TAB)

N67-11026# Lehigh Univ., Bethlehem, Pa. Inst. of Research.
GEOMETRIC DISCONTINUITIES IN ELASTOSTATICS
M. K. Kassir and G. C. Sih Jun. 1966 32 p refs
(Contract Nonr-610(06))
(TR-3; AD-639501) CFSTI: HC $2.00/MF $0.50

Three-dimensional elastostatic problems for an infinite solid with geometric discontinuities are formulated and solved with the aid of potential functions. In the problem of a linearly varying pressure specified over a plane region bounded by an ellipse, use is made of the gravitational potential at an exterior point of a homogeneous elliptical disk. The problem of prescribing displacements on the surfaces of discontinuity is governed by the Newtonian potential of a simple layer distributed over a disk in the shape of the region of discontinuity. The mass density of the disk is proportional to the prescribed normal displacement. For an elliptically shaped region, the application of the symmetrical form of ellipeoidal coordinate leads to an integral equation of the Abel type for the potential function. It is shown that if the displacements normal to the elliptical plane are given by a polynomial in the variables x2 and y2, then the corresponding normal stress acting over the ellipse is also a polynomial. The results given in this report are useful in the prediction of the stability behavior of elastic solids containing geometric discontinuities. (Author) TAB

N67-11065# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTAL EQUATIONS FOR SHELLS WITH NEARLY REGULAR MIDDLE SURFACES
SHU-TAO Chen 15 Jun. 1966 22 p refs Transl. into ENGLISH from Li Hsueh Hsueh Apo (Communist China), v. 7, no. 3, 1964 p 196–210
(FTD-TT-65-1057; TT-66-62323; AD-639483) CFSTI: HC $1.00/MF $0.50

Translation of Chinese research: fundamental equations for shells with nearly regular middle surfaces. TAB

N67-11069# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRESS STATE OF A ROTATING CONICAL SHELL WITH A THICK WALL WHICH CHANGES LINEARLY
A. D. Kovalenko 23 Feb. 1966 35 p refs Transl. into ENGLISH from Izvh. Sb. (Moscow), v. 9, 1951 p 143–166
(FTD-TT-65-1460; TT-66-62348; AD-639486) CFSTI: HC $2.00/MF $0.50

The stress state of a conical shell rotating relative to its axes and the thickness of its wall decreases from a peak linearly, and the angle between the generatrix and the axis close to a straight line is discussed. Such a shell finds application in the wheels of turbo compressors, etc. The study was carried out, according to the moment theory, on symmetrically loaded thin shells of rotation. However, the shift from the system of two equations to one differential equation of the second order, suggested in this work, differs from the corresponding shift of Meysner; the latter attained not the proper selection of the fundamental variables, but

the use of the general properties of hypergeometric equations. With the aid of the relationships between hypergeometric functions the calculation of these particular solutions were completed. The intensification of the convergence of infinite series entering into the solutions and the decrease of the number of series needed to be summed were attained simultaneously. The expressions for the solutions were compiled in simple form, containing coefficients which depend on the relative meridional coordinate and geometric parameter - the criterion of a similar stress state of a conical shell with a linear change of thickness. This made the tabulation of the coefficients easier. (Author) TAB

N67-11079# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME DIRECT METHODS IN THE NONLINEAR THEORY OF SHALLOW SHELLS

I. I. Vorovich 13 Jun. 1966 38 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 20, 1956 p 449–474

(FTD-TT-65-1744; TT-66-62357; AD-639553) CFSTI: HC $2.00/MF $0.50

Translation of Russian research: some direct methods in the nonlinear theory of shallow shells. TAB

N67-11088# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SMALL NATURAL OSCILLATIONS OF TRIPLE-LAYER SHELLS OF ROTATION

V. G. Suvernev 7 Jun. 1966 10 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Sibirskoz Otd. (Moscow), no. 2, 1964 p 93–98

(FTD-TT-65-1874; TT-66-62362; AD-639556) CFSTI: HC $1.00/MF $0.50

The natural oscillations are investigated of hollow elastic triple-layer shells of rotation with nonsymmetrical by thickness structure. The inertia is considered only in the transverse direction. The filler is considered rigid and transversal-isotropic, carrying layers- isotropic, the material- different, shell- freely supported. In the role of partial cases, oscillations of cylindrical and spherical shells are discussed Author (TAB)

N67-11135# Nottingham Univ. (England).

BENDING STRESSES IN A SHAFT WITH A TRANSVERSE HOLE

H. Fessler and E. A. Roberts [1966] 14 p refs

The magnitude and position of the greatest direct stress near a transverse hole in a shaft were determined by the frozen stress photoelastic technique. Calculations based on simple bending theory show that the greatest nominal bending stress occurs when the axis of the hole is not quite in the plane of bending. For the shape used, this nominal stress was 0.7% greater than the maximum stress when the axis of the hole lies in the plane of bending. The latter case was therefore studied because the symmetrical stress distribution in the model permits a more complete analysis to be made. The shaft was a model of a cantilever type rotating bending fatigue specimen. Since fatigue cracks originate at the surface, only surface stresses have been determined. The fatigue specimens were necked to increase the mean stress at the hole. The neck radius was 18 neck diameters, and the results are considered to apply to cylindrical shafts also. Author

N67-11143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ABOUT A CERTAIN PROBLEM OF THE OSCILLATIONS OF AN ORTHOTROPIC PLATE PLACED IN A HIGH- TEMPERATURE FIELD

S. A. Ambartsumyan 13 Jun. 1966 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR. Ser. mekhan. i. Mashin. (Moscow), no. 4, 1963 p 133–137

(FTD-TT-65-1931; TT-66-62233; AD-638883) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: about a certain problem of the oscillations of an orthotropic plate placed in a high-temperature field. TAB

N67-11144# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

POLARIZATION-OPTICAL METHOD OF INVESTIGATING STRESSES AND DEFORMATIONS

P. I. Polukhin, V. Yu. Markovskiy, and M. P. Shaskal'skaya 28 Jun. 1966 5 p Transl. into ENGLISH from Russian Patent no. 162685 (Appl. no. 836006/26-10, 9 May 1963) 1 p

(FTD-TT-65-1933; AD-639158) CFSTI: HC $1.00/MF $0.50

The object of the invention is a polarization-optical method of investigating stresses and deformations. For the purpose of simultaneously investigating the elastic and the plastic stresses and deformations. The surface of the specimen intended for investigation is covered by a layer of pure metal on which afterwards one applies a layer of material for studying the deformations and the observations are made in reflected light. Author (TAB)

N67-11152# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

USE OF THE ELECTROMAGNETIC METHOD FOR INVESTIGATING RESIDUAL THERMAL STRESSES IN CERAMICS

V. N. Rudakov 13 Jun. 1966 14 p refs Transl. into ENGLISH from the book "Nauchnoye Soveshchaniye po Teplovym Napryazheniyam v Elementakh. Doklady 4: Konstruktsii" Kiev, "Naukova Dumka" Publishing House p 314–322

(FTD-TT-65-1965; TT-66-62234; AD-638884) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: use of the electromagnetic method for investigating residual thermal stresses in ceramics. TAB

N67-11191# Applied Physics Lab., Johns Hopkins Univ.,

TORSIONAL FREQUENCIES OF UNIFORM SHAFTS WITH ELASTIC RESTRAINTS AND ELASTICALLY ATTACHED MASSES

Nathan Rubinstein, Vincent G. Sigillito, and James T. Stadter Jun. 1966 51 p refs

(Contract NOw-62-0604-c)

(TG-833; AD-639181) CFSTI: HC $2.00/MF $0.50

Numerical upper and lower bounds are given to eigenvalues of torsional vibration of the following uniform structures: free shaft elastically restrained at a point; fixed shaft elastically restrained at a point; free shaft with masses elastically attached at points; fixed shaft with a mass elastically attached over an interval. Upper bounds were obtained using the well-known Rayleigh-Ritz procedure, lower bonds were obtained using methods developed by Bazley and Fox Author (TAB)

N67-11194# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.

INVESTIGATIONS OF THE QUASI-STATIC AND DYNAMIC RESPONSE OF GRANULAR SOILS Final Report, Oct 1964–Mar. 1966

Robert D. Stoll, Ibrahim A. Ebeido, and Milton S. Hess Mar. 1966 85 p refs

(Contract NBy-32198)

(TR-3; AD-638009) CFSTI: HC $3.00/MF $0.75

The report describes experimental studies of shock-induced sustained-amplitude stress waves in soil. A general analysis is made of wave propagation in a cylindrical bar. The mathematical

model includes stress relaxation and radial inertia factors. Also included is analytical interpretation of unloading wave propagation. Unloading waves were generated experimentally by suddenly unloading a previously loaded cylindrical specimen. The analysis results in a theory which accounts for longitudinal, axial, and radial shear modes. Preliminary results are presented of experiments involving earth shock with spherical symmetry. Quasi-static isotropic compression tests and their associated problems are discussed. Author (TAB)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N67-10005# Sheffield Univ. (England). Dept. of Fuel Technology and Chemical Engineering.
INTENTIONAL COMBUSTION OSCILLATIONS IN PROPULSION SYSTEMS Final Scientific Report
D. Harris, R. J. Parsons, and J. Swithenbank 25 Apr. 1966 63 p refs
(Grant AF-EOAR-65-23)
(HIC-74; AFOSR-66-1438) CFSTI: HC $3.00/MF $0.75

CONTENTS:
1. INTENTIONAL COMBUSTION OSCILLATIONS IN PROPULSION SYSTEMS 24 p refs
2. THE DESIGN AND CONSTRUCTION OF A SHOCK TUNNEL TEST SECTION FOR VELOCITY MEASUREMENT STUDIES R. J. Parsons 35 p refs (See N67-10006 01-11)

N67-10034# Ibrape, S. A. (Brazil).
HEATSINKS
[1966] 22 p ref
(P-39) CFSTI: HC $1.00/MF $0.50

Heatsinks, which transfer the dissipated heat from a semiconductor junction to ambient air by convection and radiation, and discussed. Details are given regarding the proper way of connecting a diode to a heatsink and positioning the heatsink. In addition to information on heat transfer and the mechanical construction of assemblies, useful indications of how to take advantage of reverse-polarity diodes are presented. Technical data on various types of heatsinkds and examples of calculations are included. S.P.

N67-10042# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION OF GRAPHITE IN AN AIR STREAM AT HIGH TEMPERATURES
N. A. Anfimov *In its* News of the Acad. of Sci. of the USSR, Mech. and Machine Building 26 Mar. 1966 p 1-20 refs (See N67-10041 01-23) CFSTI: HC $4.00/MF $0.75

A theoretical investigation of graphite mass removal is presented, using a numerical solution of equations for a multicomponent boundary layer. A system of differential equations for concentrations is obtained. The derivatives of diffusion streams are expressed by means of equations of continuity of individual components, and the second derivative of temperature is expressed by the energy equation. The sequence in the solution is outlined, and simplified methods are described. It was concluded that in the diffusion calculation method, the rate of graphite deterioration is most important, and the surface temperature is a stable factor. The importance of oxygen dissociation and of the mechanism of the graphite mass removal are discussed. N.E.N.

N67-10135# Aktiebolaget Atomenergi, Stockholm (Sweden).
VOID MEASUREMENTS IN THE REGIONS OF SUB-COOLED AND LOW-QUALITY BOILING. PART I: LOW MASS VELOCITIES
S. Z. Rouhani Jul. 1966 49 p refs
(AE-238) CFSTI: HC $2.00/MF $0.50

By the application of the (γ,n) reaction to boiling heavy water, void volume fractions have been measured in a vertical annular channel with 25 mm O.D. and 12 mm I.D. at a heated length of 1090 mm. The experiments covered pressures from 10 to 50 bars, mass velocities from 50 to 1450 kg/m^2-sec, heat fluxes from 30 to 90 W/cm^2, subcoolings from 30 to 0°C, and steam qualities from 0 to 15%. The results indicate noticeable effects of pressure, heat flux and even mass velocity upon the variations of void with subooling and steam quality. A novel explanation of the mechanism of their effects has been found and proved by qualitative analysis. Author

N67-10181*# National Aeronautics and Space Administration, Washington, D. C.
THE LAMINAR BOUNDARY LAYER IN A RADIATING-ABSORBING GAS NEAR A FLAT PLATE [LAMINARNYY POGRANICHNYY SLOY V IZLUCHAYUSHCHE-POGLOSHCHAYUSHCHEM GAZE OKOLO PLOSKOY PLASTINKI]
V. P. Zamurayev Dec. 1965 14 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 3, 1964 p 73-80
(NASA-TT-F-411) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Radiative heat transfer and the laminar boundary layer near a flat plate are discussed. Several simplifying assumptions about radiative heat transfer are reviewed, and application is made of the hypothesis of local thermodynamic equilibrium, according to which the radiating power and the coefficient of absorption are related to Kirchhoff's law. The medium is assumed to be gray and the wall, absolutely black. The physical properties of the medium may be temperature dependent. The asymptotic behavior of heat transfer far away from the tip of the plate is considered. A difference method of solving a system of partial differential equations with a complex integrodifferential energy equation is used to solve the problem over the entire length of the plate. R.U.

N67-10220*# National Aeronautics and Space Administration, Washington, D. C.
IRREVERSIBLE THERMODYNAMICS AND DERIVATION OF A SYSTEM OF DIFFERENTIAL EQUATIONS OF MOLECULAR TRANSFER [TERMODINAMIKA NEOBRATIMYKH PROTSESSOV I VYVOD SISTEMY DIFFERENTSIAL'NYKH URAVNENIY MOLEKULYARNOGO PERENOSA]
P. V. Tsoy Oct. 1966 9 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 9, no. 3, 1965 p 318-322
(NASA-TT-F-10318) CFSTI: HC $1.00/MF $0.50 CSCL 20M

Derivation of a system of differential equations of molecular transfer for the case of n interrelated fluxes of generalized charges are presented. The derivation is carried out on the basis of linear laws of irreversible thermodynamics and the law of conservation of matter. Methods of solving boundary-value problems for this system of equations are discussed. Author

N67-10294# Naval Ordnance Lab., White Oak, Md.
EFFECT OF A HIGHLY COOLED WALL ON HYPERSONIC TURBULENT HEAT TRANSFER
Donald M. Wilson and Paul D. Fisher 1 Jun. 1966 49 p refs *Its* Aerodyn. Res. Rept.-250
(NOLTR-65-153; AD-638232) CFSTI: HC $2.00/MF $0.50

Turbulent heat-transfer rates were measured on a thin-walled, slender cone in a hypersonic tunnel at a free-stream Mach number of 5.0. Wall-to-stagnation temperature ratios of approximately 0.3 and 0.45 were obtained by cooling the model with liquid CO2. A wide range of test Reynolds numbers were obtained by varying

the tunnel supply pressure. This provided data for both laminar and mixed laminar - turbulent boundary-layer conditions. The experimental results are compared with existing theories which predict convective heat-transfer coefficients. These comparisons substantiate the predictions of Winkler and Cha for the present test conditions Author (TAB)

N67-10348# Toronto Univ. (Ontario). Lash Miller Chemical Labs.
ENERGY DISTRIBUTION IN FLAMES AND ELECTRICAL DISCHARGES Final Scientific Report
Jacques M. Deckers Aug. 1966 18 p refs
(Grant AF-AFOSR-375-64)
(AFOSR-66-1859; AD-638678) CFSTI: HC $1.00/MF $0.50

Energy distribution in flames: It is shown that it is possible to obtain the original distribution of the energy among the rotational levels of the CH radical formed in hydrocarbon oxygen flames at low pressure. Amongst the higher rotational levels the energy is found to be statistically distributed corresponding to a temperature of 2300K. Below 9 torr it is not affected by energy transfer but at higher pressures enough energy transfer collisions take place so that the energy distribution becomes affected before radiation takes place. Certain diluents introduced in the flame such as carbon dioxide are more effective than others, nitrogen in particular. Electrical discharges through oxygen: Four different types of DC glow discharges were found to occur in oxygen. They are best characterised by the type of oscillation of the potential at the off ground electrode. The field in the positive column of these discharges was measured between 0.5 and 5 torr. Langmuir probe characteristics have shown that significant changes occur in the electron energy distribution. The temperature first increases due to an increase in the concentration of positive ions and then decreases due to the formation of negative ions Author (TAB)

N67-10434# Library of Congress, Washington, D. C. Aerospace Technology Div.
SOLID PROPELLANT COMBUSTION Surveys of Foreign Scientific and Technical Literature, Jan. 1962–May 1966
Paul Vantoch and Seraphim Parandjuk 8 Aug. 1966 73 p refs Anal. Surv.
(ATD-66-68)

This analytical survey contains a general discussion of selected articles on solid propellant combustion and comprises the abstracts of these articles. The information is divided into 8 sections: (1) The effect of pressure; (2) Particle size, porosity, and density; (3) The effect of temperature; (4) Condensed phase reactions; (5) Ignition characteristics; (6) Additives and catalytic effects; (7) Theoretical stability criteria; (8) Miscellaneous. The material reviewed indicates that Soviet investigators are placing emphasis on the following theee areas: the relationships between the pressure and the burning velocity; the effect of porosity, particle size, and density on burning velocity and instability; and condensed-phase reactions. Author

N67-10500# Naval Ordnance Lab., White Oak, Md.
A SIMPLIFIED MEANS OF PROVIDING FIRST ESTIMATES TO LAMINAR HEATING RATES ON ISOTHERMAL AXISYMMETRIC BLUNT BODIES
Michael J. Werle (M.S. Thesis–Virginia Polytech. Inst.) 31 May 1966 53 p refs
(NOLTR-65-171; Aerodynamics Res. Rept.-252; AD-638679) CFSTI: HC $3.00/MF $0.50

An approximate method has been developed for the rapid calculation of first estimates to the laminar heat transfer distribution over isothermal, axisymmetric blunt bodies. Results of the method are compared with experimental data, first-order numerical solutions, and with values obtained from Lees' approximate scheme. In all cases fair to good results were obtained. (Author) TAB

N67-10545# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
STRUCTURE OF A MULTIFRONT DETONATION WAVE IN A GAS
R. I. Soloukhin Sep. 1966 12 p refs Transl. into ENGLISH from Nauchno-Tekhn. Probl. Goreniya i Vzryva (USSR), v. 2, 1965 p 35–42
(T-454-R) CFSTI: HC $1.00/MF $0.50

Results of some combined approach investigations of multifront detonation waves in a gas are described. Experiments were conducted in which the pressure, density, temperature, and luminosity at the wave front were recorded with a time resolution of less than 0.5 microseconds. These experiments revealed that the combustion of the gas behind the detonation shock front essentially is not a one dimensional process. It was found that the zone of chemical conversion is, through hydrodynamic effects, broader by at least an order of magnitude than the exepcted one dimensional reaction zone. C.T.C.

N67-10550# Fiat S.p.A., Turin (Italy). Seziona Energia Nucleare.
AN INVESTIGATION ON SOME PARAMETERS INFLUENCING NON-UNIFORM HEAT FLUX DNB PREDICTION
G. Previti and M. De Bernardi Brussels, EURATOM, Aug. 1966 54 p refs
(Contract EURATOM-008-61-12 PNII)
(EUR-3114.e) CFSTI: HC $3.00/MF $0.50

In nuclear reactor core thermal design only non-uniform axial heating must be considered. The shape of the heat flux distribution varies over the core lifetime; therefore it is important to be able to correctly predict the effect of non-uniform axial flux distribution on DNB (Departure from Nuclear Boiling). Recent tests conducted by various laboratories have shown a marked influence of the heat flux distribution both on DNB power and location point. A correction factor, derived by a theoretical analysis, has been proposed in order to predict non uniform heat flux DNB conditions from corresponding uniform flux data. Scope of the present work is to define the field of applicability of the theoretical approach to point out the role of some important parameters such as DNB length and pressure, and to modify the theoretical analysis for the high quality region. An analytical expression for the factor

$$C = \frac{h}{pV \, s \, Cp}$$

in a bubbly flow region has been derived. Author

N67-10554# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
FRICTION AND FLUX OF TURBULENT HEAT IN TWO-DIMENSIONAL AND THREE-DIMENSIONAL FLOW [FROTTEMENT ET FLUX DE CHALEUR TURBULENTS EN ECOULEMENTS BI- ET TRIDIMENSIONNELS]
Roger Michel and Ngo Duc Lam 1964 17 p In FRENCH Presented at the 11th Intern. Congr. of Appl. Mech., Munich, 30 Aug.–5 Sep. 1964
(TP-151/1964) CFSTI: HC $1.00/MF $0.50

An analysis of the results obtained in various problems of turbulent boundary layer, from a consideration of a series of boundary-layer equations, is presented. An approximation, using the hypothesis of flat plate relationships for the coefficients of friction and heat flux as a function of Reynolds numbers of boundary layer densities, is applied to three problems: turbulent heat flux on the forebody of a blunt missile, friction of incident delta wings, and turbulent heat flux of an infinite arrow cylinder. Transl. by R.U.

N67-10555# France. Office National d'Etudes et de Recherches Aerospatiales, Chatillon-sous-Bagneux.
HEAT FLUX AT LEADING EDGE OF ARROW WING WITH STRONG DEFLECTION [FLUX DE CHALEUR AU BORD D'ATTAQUE D'UNE AILE A FORTE FLECHE]

Roger Michel and Vinh-Hung Duong 1964 34 p refs In FRENCH Presented at the 4th Congr. of the Intern. Council of Aeron. Sci., Paris, 24–28 Aug. 1964
(TP-116(1964)) CFSTI: HC $2.00/MF $0.50

An experimental and theoretical study of heat transfer at the leading edges of arrow wings, for Mach numbers 7 and 10, is presented. An approximation, based on the integration of the global energy equation of the three-dimensional boundary layer is applied to the calculation of heat flux along the leading edge where the arrow wing configuration varies from 50° to 80°. Results are compared with those of an experimental study involving pressure measurements. The effect of entropy gradient due to the curve of the shock wave is also mentioned. Transl. by R.Li.

N67-10589# Atomic Energy Establishment, Winfrith (England). Reactor Development Div.
BURNOUT IN A CHANNEL WITH NON-UNIFORM CIRCUMFERENTIAL HEAT FLUX
D. H. Lee Mar. 1966 27 p refs
(AEEW-R-477) HMSO: 4s

Burnout experiments are reported for uniform flux and circumferential flux tilt (maximum/average flux about 1.25) with tubes and annuli, all the experiments having uniform axial heating. These show similar results, the burnout power with flux tilt being within 10% of that with uniform flux. For the same mean exit steam quality, the local maximum flux is higher than the predicted burnout value and generally a better prediction is obtained using the average flux. Author

N67-10640# United Kingdom Atomic Energy Authority, Harwell (England). Chemical Engineering Div.
BIBLIOGRAPHY OF REPORTS ON TWO-PHASE HEAT TRANSFER ISSUED BY A.E.R.E., HARWELL
L. B. Cousins May 1966 18 p refs
(AERE-BIB-150) HMSO: 3s

Listings and summaries are presented on the reports and publications issued by the Two-Phase Heat Transfer Section of the Chemical Engineering Division at A.E.R.E., Harwell. The reports are divided into two main sections: burnout and heat transfer studies on steam-water systems and hydrodynamic studies on air-water systems. A list of other relevant reports issued by A.E.R.E. Harwell is given in a supplement. Author (NSA)

N67-10669# Bettis Atomic Power Lab., Pittsburgh, Pa.
TOPS: A FORTRAN PROGRAM FOR THE TRANSIENT THERMODYNAMICS OF PRESSURIZERS
J. A. Redfield and S. G. Margolis Dec. 1965 38 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-545) CFSTI: HC $2.00/MF $0.50

The TOPS program is a digital simulation of pressurizer dynamics based on a rigorous application of the first law of thermodynamics and phenomenological heat and mass transfer laws with empirically determined coefficients, which is an extension of the initial model development done with analog computer studies. The program is useful in studying the thermodynamic paths of pressurizer transients, and is convenient to use as a design tool. A comparison with experimental data is included in order to demonstrate the validity of this analysis method. In the TOPS representation of the pressurizer, no *a priori* assumptions are made concerning the particular thermodynamic process followed during insurge or outsurges. This contrasts with most currently used models, in which some predetermined process (isentropic compression, saturation-line, etc.) is built into the model. In the representation used here, the program itself determines the thermodynamic process at each instant of the transient. In addition it is possible to simulate the special cases of isentropic and saturation line paths by appropriate selection of the heat and mass transfer coefficients. The pressurizer equations are developed in detail for the simplified geometric representation of the pressurizer, the numerical methods are presented, the selection of heat and mass transfer coefficients is determined, and a comparison with experiments is discussed. Author (NSA)

N67-10670# Los Alamos Scientific Lab., N. Mex.
CRITICAL NUCLEATE BOILING OF LIQUID HELIUM IN A SIMULATED WIRE-WOUND MAGNET
S. G. Sydoriak and T. R. Roberts [1966] 8 p refs Presented at the Intern. Inst. of Refrig. Comm. I Meeting, Boulder, Colo.
(Contract W-7405-ENG-36)
(LA-DC-7801; CONF-660628-3) CFSTI: HC $1.00/MF $0.50

The applicability of the equation $Q = A_x L \sqrt{\rho_V \rho_L f Z g}$, which is a theoretical relation for the total heat transfer of boiling heat transfer in narrow channels and where A_x is the horizontal cross section of the channels (not the heated area), L the heat of vaporization, ρ_V and ρ_L the vapor and liquid densities, f the quality of mass fraction of vapor in the fluid leaving the top of the channel, g the gravitational acceleration and Z the height of the channel if immersed in a bath or the hydrostatic head equivalent to a driving pressure in the case of forced flow in a heated channel, to the problem of stabilization of superconducting magnets by incorporation of channels for flow of liquid helium is discussed. NSA

N67-10672# Rutgers Univ., New Brunswick, N. J. Dept. of Mechanical Engineering.
CONVECTIVE HEAT TRANSFER TO GAS-SOLIDS SUSPENSIONS AT A REYNOLDS NUMBER OF 130,000
Richard L. Peskin and Richard Briller May 1966 77 p refs
(Contract AT(30-1)-2930)
(NYO-2930-7; TR-109-ME-F) CFSTI: HC $3.00/MF $0.75

An experiment was performed to determine the convective heat transfer coefficient to heated and cooled gas-solids suspensions at a Reynolds number of 130,000. Particle size and solid loading ratio were varied. Measurements of the heat gained or lost by the suspension were made by traversing the stream at various positions with specially designed probes which measured the air temperature and solids temperature locally. The temperature profiles thus measured, along with flow rates of solids and air and the pipe wall temperature determined the heat transfer coefficient. The results showed that for this high a Reynolds number, the heat transfer coefficient for the gas solids suspension appears to equal that of air alone at the same Reynolds number. This effect is independent of solid loading ratio, heating or cooling, and particle size (between .0011" and .0058" diameters). Author (NSA)

N67-10677# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
INTEGRAL NEUTRON THERMALIZATION Quarterly Progress Report, Period Ending 31 Mar. 1966
H. Atunez, J. R. Beyster, W. Brouwer, G. Carriveau, J. U. Koppel et al 22 Apr. 1966 208 p refs
(Contract AT(04-3)-167)
(GA-7091) CFSTI: HC $6.00/MF $1.25

A progress report is presented on integral neutron thermalization, which includes theoretical studies, experimental and analytical studies, and experimental and calculational techniques. NSA

N67-10693# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
FORCED CONVECTION SUBCOOLED BOILING: PREDICTION OF VAPOR VOLUMETRIC FRACTION
S. Levy Apr. 1966 33 p refs
(Contract AT(04-3)-189)
(GEAP-5157) CFSTI: HC $2.00/MF $0.50

A model is developed to predict the vapor volumetric fraction during forced convection subcooled boiling. The proposed method of calculation consists of three steps: the point of bubble departure

from the heated surface (i.e., the location of vapor volumetric fractions significantly higher than zero) is determined from a bubble force balance and the single-phase liquid turbulent temperature distribution away from the heated wall, a relation is postulated between the true local vapor weight fraction and the corresponding thermal equilibrium value, and the vapor volumetric fraction is obtained from the true local vapor weight fraction and an accepted relationship between vapor weight and volumetric fractions. The method was applied to a variety of available test data, and the agreement was satisfactory for a multitude of flow, heat flux, and fluid property conditions. Author (NSA)

N67-10745*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF THE PRESSURE CHARACTERISTICS OF NONWETTING, CONDENSING FLOW OF MERCURY IN A SODIUM-POTASSIUM-COOLED, TAPERED TUBE

Richard W. Vernon, Roy A. Lottig, and William D. Kenney Washington, NASA, Nov. 1966 35 p refs

(NASA-TN-D-3691) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Experimental data obtained to define the inlet pressure and pressure drop characteristics for nonwetting mercury flow in a single, tapered diameter tube cooled by NaK are presented, and a comparison is made to the predicted static-pressure profiles obtained by the correlations of Lockhart–Martinelli and Koestel et al. It was concluded that (1) the Hg inlet static pressure exhibited a high sensitivity to changes of condensing lengths and became much less sensitive as the condensing length was increased; (2) the experimental pressure difference for the condensing length varied from a small pressure rise which occurred for condensing lengths of less than 20 in., to a small pressure drop, which occurred at a condensing length of 34 in.; (3) the Lockhart–Martinelli correlation profiles generally agreed with static pressures measured in the first 75% of the vapor length when the assumed liquid-to-vapor velocity ratio was both 0.5 and 1.0; and (4) the Koestel fog flow model, in which the liquid-to-vapor velocity ratio was assumed to be 1.0, resulted in pressure profiles that generally agreed with measured pressures in the first 75% of the condensing length. L.E.W.

N67-10756*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CRITICAL FLOWRATE OF TWO-PHASE NITROGEN

Hugh M. Campbell and Thomas J. Overcamp 18 Jul. 1966 52 p refs

(NASA-TM-X-53492) CFSTI: HC $2.50/MF $0.50 CSCL 20M

Experiments were done to learn the critical flow rate of two-phase nitrogen through an orifice. Recent analysis of the critical flow rate of a two-phase fluid are summarized and compared with experimental data. The experimental data appear to fit Ward's analysis better than any other analysis. Author

N67-10779# Brookhaven National Lab., Upton, N. Y.

A SPACE-INDEPENDENT MODEL OF TWO-PHASE FLOW AND ITS APPLICATION TO EXPERIMENT

Louis M. Shotkin Jan. 1966 28 p refs

(Contract AT(30-2)-GEN-16)

(BNL-963) CFSTI: HC $2.00/MF $0.50

A space-independent model of a boiling hydraulic channel is presented. The model includes two empirical constants–the single-phase friction coefficient and the K-factor in Bankoff's slip ratio relation–and requires a knowledge of the steady-state relation between heat input and flow rate. Linearized analytical results are compared, with reasonably good agreement, with several transfer functions measured by Zivi, Wright, et al. in a boiling loop at atmospheric pressure using both natural and forced circulation. The necessity of applying a heat source correlation to the experimental data is discussed, and the role that the dynamic pressure plays is presented. The physical mechanism causing the experimentally observed hydraulic instability is shown to be an interaction between the transient flow and friction pressure drop in the two-phase region. The experimentally observed increase in unstable oscillation frequency with inverse boiling length is also shown analytically. The position of the boiling boundary in the channel is shown to be important in stability considerations. By comparing analytical results with experimental data of Wissler et al. and Becker et al., it is concluded that the least stable situation results when the boiling boundary is part-way up the channel. Since the position of subcooling, the existence of this crucial position is used to explain the influence of subcooling on stability. Author (NSA)

N67-10789*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SUMMARY OF LIGHT-INTENSITY DATA OF EIGHT TRAILBLAZER I REENTRY BODIES

T. Dale Bess Washington, NASA, Nov. 1966 51 p refs

(NASA-TN-D-3697) CFSTI: HC $2.00/MF $0.50 CSCL 20M

Results of experimental measurements of light intensity of the reentry test bodies of eight Trailblazer I vehicles are presented along with position and velocity measurements of each test body. In order to compare the luminous efficiencies of the eight Trailblazer I reentries with luminous efficiencies of higher velocity reentries, results of two high-velocity steel-pellet reentries are presented. All data were reduced from photographs taken with ballistic and modified aerial cameras located at various camera sites. Tests were made on reentry bodies made of six different materials: aluminum, steel, copper, titanium, phenolic-nylon, and an epoxy-base material. The phenolic-nylon and the epoxy-base materials were ablative. Results of the light intensity measurements show that the amount of panchromatic light energy given off is largely due to the material of which the test object is made. The total integrated luminous energy of the metals in decreasing order were: titanium, steel, aluminum, and copper. The two reentries using phenolic-nylon and an epoxy-base material gave luminous intensities not nearly as bright as those of the metal reentries. The shape of the light curves of the ablative materials indicates that these materials have an almost constant intensity with no pronounced flaring. Author

N67-10804# Atomic Energy Establishment, Winfrith (England).

BURNOUT IN CLIMBING-FILM TWO-PHASE FLOW. A REVIEW OF THEORIES OF THE MECHANISM

G. J. Kirby Mar. 1966 63 p refs

(AEEW-R-470) HMSO: 9s

Burnout data for annular flow are examined and it is shown that for qualities above 10% the burnout heat flux is a function only of pressure, $D^{1/2}G$ and quality to within the errors in the experimental data. The various burnout models are examined and none are found to predict the trends given by the above function. The literature on droplet deposition, entrainment and onset of annular flow is studied to see if any new light can be thrown on the problem of burnout. Actual values for the deposition rate of droplets in a boiling channel are derived and it is hoped that these will provide a basis for further studies of possible burnout models. Author (NSA)

N67-10942# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

AN APPROXIMATE METHOD OF CALCULATING A THERMALLY INSULATED LAYER WITH ACCOUNT TAKEN OF RADIATION

G. A. Matuzok 29 Jul. 1966 13 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), v. 7, no. 3, 1964 p 117–123

(Contract NOw-62-0604-c)

(TG-230-T493; TT-66-62290; AD-639183) CFSTI: HC $1.00/MF $0.50

The problem of calculating the heat field of the plate of a plate-insulator system radiating heat to the ambient medium is solved. Assuming that the thermal characteristics of the material are constant and the temperature gradient over the thickness is zero, the problem reduces to the solution of a one-dimensional equation of heat conduction with initial T = T sub zero and tau = zero. Veinik's approximate method is discussed, where the virtual temperature distribution over the thickness is approximated by a polynomial to find solutions for problems that cannot be solved by using exact methods. The heating process is divided into two stages: the first stage, where the change in temperature field spreads over the entire thickness of the insulator, and the second stage, where heating takes place simultaneously over the entire plate thickness. (Author) TAB

N67-10980# Utah Univ., Salt Lake City. Dept. of Chemical Engineering.
IGNITION OF AMMONIUM PERCHLORATE-BASED PROPELLANTS BY CONVECTIVE HEATING
John A. Keller 1 Aug. 1966 427 p refs Presented at the 3d Aerospace Sci. Meeting, New York City, Jan. 1965
(Grants AF-AFOSR-40-63; AF-AFOSR-40-64)
(AFOSR-66-1856; AD-638647) CFSTI: HC $7.25/MF $2.00

A study was made of the ignition of ammonium perchlorate-based propellants by convective heat fluxes of 20 to 160 cal/(sq. cm) (sec) in a shock-tube apparatus. The results of this research showed that ammonium-perchlorate propellants ignite by a thermal process in which the slow step in the sequence of events which lead to steady deflagration of the propellant is raising the surface to its ignition temperature. The results also suggest that the key chemical process in ignition is the thermal decomposition of ammonium perchlorate; reactions involving fuel ingredients become important immediately following that reaction. Deviations from behavior predicted by simple thermal theory were found for propellants with rough surfaces, but not for those with smooth surfaces. Author (TAB)

N67-11046# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
TRANSIENT TEMPERATURES OF ARRAYS OF PLATES AND CUBES RADIATING IN A VACUUM
D. F. Winter Jul. 1966 23 p refs
(D1-82-0547; AD-638906) CFSTI: HC $1.00/MF $0.50

When certain conditions are satisfied, the temperature history of an evacuated particulate medium is determined primarily by radiative exchange between surfaces of solid material. This paper presents a discussion of transient radiative heat exchange in two simple types of evacuated discontinuous media with gray surfaces: (1) a semi-infinite array of thin parallel plates and (2) a plane-bounded semi-infinite array of small cubes, contiguous at their vertices. The equations which describe heat transfer within these arrays are presented, together with numerical results. Calculations for special cases are compared with solutions of the heat conduction equation with a radiant conductivity and an appropriate radiative boundary condition. Models such as those discussed may be useful in describing transient radiative heat exchange at the surface of the Moon Author (TAB)

N67-11080# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTENSIFICATION EFFECT OF ULTRASONIC WAVES ON THE HEAT TRANSFER PROCESS BETWEEN LIQUIDS OUTSIDE AND INSIDE THE TUBES
Hwa-Ting Cheng 31 May 1966 14 p Transl. into ENGLISH from Wu Li Hsueh Pao (Peking), v. 20, no. 4, 1964 p 368-373
(FTD-TT-65-1766; TT-66-62287; AD-639161) CFSTI: HC $1.00/MF $0.50

Conclusions: (1) The heat transfer process can be intensified by the use of ultrasonic vibration. The experimental results showed that the average rate of increase of the coefficient of thermal conductivity between hot and cold was 80%. That between water and lubricating oil remained at 20%. (2) The result of the effect of ultrasonic wave was far from the maximum limiting value. Following the experimental results and theoretical discussions, it can be predicted that a still larger intensification effect may be obtained. An equation is given which suggests the main avenue of approach towards that goal Author (TAB)

N67-11112# Grumman Aircraft Engineering Corp., Bethpage, N. Y.
A SIMPLIFIED COMPUTER TECHNIQUE FOR THE CALCULATION OF EXHAUST PLUMES WITH CHEMICAL REACTIONS
David Migdal Dec. 1965 12 p refs
(ADN-01-10-65.1)

A computer program for predicting the flow field in arbitrary shaped rocket nozzles is extended to include the nozzle plume region. This allows the analysis of both nozzle and plume at one time or either one independently. The irrotational method of characteristics for axisymmetric flow is used with approximate kinetic analysis. Several simplifying assumptions were utilized to handle the interior shock present in the jet plume. The approximations yield no appreciable error when compared to experimental data and more exact analysis. An existing equilibrium thermochemical program was modified to compute ionized species to be used as input to the nozzle-plume program. These results will be incorporated in the plume analysis to yield more accurate estimates of the presence of free electrons in the exhaust plume. Author

N67-11120# National Bureau of Standards, Boulder, Colo.
LIQUID HELIUM TECHNOLOGY AT THE NATIONAL BUREAU OF STANDARDS
R. B. Scott [1966] 14 p refs Presented at the Intern. Inst. of Refrig. Comm. I Meeting, Boulder, Colo., 16-18 Jun. 1966 Available from Natl. Bur. of Std., Boulder, Colo.: $0.70

An overview is presented of various aspects of liquid helium technology and research conducted at the National Bureau of Standards during the past three decades. Mention is made of the first helium liquifier which came into being in 1934, experiments on superconductivity, and the development of adiabatic demagnetization processes. The Rayleigh disk experiment is described, as are various types of helium liquifiers. Specific attention is given to researches at the Boulder laboratory, including use of liquid helium as a precoolant, transportation of liquid helium and development of appropriate containers, and use as neutron moderators for use in nuclear reactors. M.W.R.

N67-11131*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
TEMPERATURE-ENTROPY DIAGRAM FOR PARAHYDROGEN TRIPLE-POINT REGION
C. F. Sindt and D. B. Mann 22 Jun. 1966 9 p refs
(NASA Order R-399)
(NASA-CR-79871; NBS-TN-343) GPO: HC $0.15; CFSTI: MF $0.50 CSCL 20M

The three-phase region at and near the triple point of parahydrogen is presented on the graphical coordinates of temperature and entropy. Isobars from 10 mm Hg to 340 atmospheres, temperatures from 11° to 23°K and specific volumes covering the range of from 10.5 cc/gm to 15,000 cc/gm are included. The energy base of enthalpy and entropy are consistent with previous data. Author

N67-11174# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF HIGH-STRESS HEAT EXCHANGER
P. I. Povarnin 31 Aug. 1966 13 p refs Transl. into ENGLISH from the Publ. "Issledovaniye Teploobmena v Potokakh Zhikosti i Gaza" Moscow, Izd. Mashinostr., 1965 p 167–174
(FTD-HT-66-426; TT-66-62245; AD-638974) CFSTI: HC $1.00/MF $0.50

Translation of Russian research: calculations of high-stress heat exchanger. TAB

N67-11189# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SOLUTION OF A MIXED STEADY-STATE HEAT-CONDUCTION PROBLEM FOR A CYLINDER
R. A. Pavlovskii 28 Jul. 1966 8 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 7, no. 11, 1964 p 73–76
(Contract NOw-62-0604-c)
(TG-230-T492; AD-639184) CFSTI: HC $1.00/MF $0.50

A solution is given to the steady-state heat-conduction problem with mixed boundary conditions for the surface of an infinitely long cylinder. The solution is obtained by conformal mapping in combination with the method of dual integral equations Author (TAB)

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N67-10101# Rome Air Development Center, Griffiss AFB, N. Y. Research and Technology Div.
PHYSICS OF FAILURE IN ELECTRONICS, VOLUME 4
Norton E. Goldberg (IIT Res. Inst.), and Joseph Vaccaro Jun. 1966 699 p refs Proc. of the 4th Ann. Symp., Held at Chicago, 16–18 Nov. 1965; Sponsored Jointly by RADC and IIT
(AD-637529) CFSTI: HC $9.65/MF $2.75

Symposium papers on fundamental physical and chemical processes which contribute to degradation, aging, and failure of electronic parts and materials, and the application of this information to the problems of reliability control, measurement, prediction, and improvement are presented. For individual titles see N67-10102–N67-10134.

N67-10192*# National Aeronautics and Space Administration, Washington, D. C.
NATIONAL SPACE RESEARCH COMMISSION, SPAIN [COMISION NACIONAL DE INVESTIGACION DEL ESPACIO]
Jun. 1964 14 p Transl. into ENGLISH from Bol. Ofic. del Estado (Madrid), no. 164, 10 Jul. 1963
(NASA-TT-F-9004) CFSTI: HC $1.00/MF $0.50 CSCL 05D

To enable Spain to participate actively in the European Space Research Organization (ESRO), a national law establishing the National Space Research Commission was promulgated. The full-text translation lists the goals of the organization, the research to be conducted, the *ex-officio* and voting members, the general organization and policy guidelines. Article X provides for the appointment of two delegates to represent the Spanish Government on the Permanent Commission of ESRO. Legal orders attached establish the membership of the National Commission for Space Research. R.U.

N67-10274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS AND COMPARISON OF THE DESTRUCTIVE FACTORS OF NUCLEAR WEAPONS OF SMALL AND HIGH POWER
Josef Janik 26 Mar. 1966 22 p refs Transl. into ENGLISH from Przeglad Wojsk Ladowych (Poland), v. 5, no. 2(44), 1963 p 125–140
(FTD-TT-64-1369; TT-66-62094; AD-637416) CFSTI: HC $1.00/MF $0.50

Data concerning the explosions of nuclear weapons are collected in this report from various accessible publications and the basic parameters of the separate destructive factors of nuclear explosions of small and high power are compared. Author (TAB)

N67-10320# Naval Postgraduate School, Monterey, Calif.
A COMPUTER SIMULATION FOR THE EVALUATION OF SURFACE-TO-AIR MISSILE SYSTEMS IN A CLEAR ENVIRONMENT
Alvin F. Andrus Jun. 1966 102 p
(TR/RP-67; AD-636943) CFSTI: HC $4.00/MF $0.75

A probabilistic event store computer simulation of the interactions between surface-to-air missile systems and aircraft in a non-jamming environment and over flat terrain is presented. The purpose of the model is to test the general disposition of missile areas and the associated missile system reaction times against an aircraft attack. A complete description of the model with the flow charts and CDC-FORTRAN-60 program listing is included. Author (TAB)

N67-10470# Pisa Univ. (Italy). Faculty of Engineering.
BREAKWATER IN REINFORCED CONCRETE FOR PROTECTION AND REPASTURING OF NARROW ERODING COASTLINES [FRANGIFLUTTO IN CEMENTO ARMATO PER DIFESA E RIPASCIMENTO DI SPIAGGE SOTTILI IN EROSIONE]
Corrado Ruggiero and Michele Auterio May 1965 14 p refs In ITALIAN Presented at the 9th Meeting on Hydraulics and Hydraulic Construction, Trieste, Italy, May 1965 Sponsored by Consiglio Nazl. delle Ric. *Its* Ser. 23, No. 1111 CFSTI: HC $1.00/MF $0.50

To assist in reclaiming eroded coastlines, a reinforced concrete breakwater was constructed, and repasturing initiated with delta grain. Mathematical expressions are derived for experiments in small canals fitted with breakwaters of varying heights. Emphasis was placed on the hydrodynamic action of waves in relation to sandy bottom conditions. Transl. by R.U.

N67-10472# European Atomic Energy Community, Brussels (Belgium).
EURATOM INFORMATION, VOLUME 10, NO. 10
Oct. 1966 204 p refs In ENGLISH, GERMAN, FRENCH, ITALIAN, and DUTCH CFSTI: HC $6.00/MF $1.25

This bibliography covers scientific reports, papers, and articles in abstracted form that were issued as results of the activities carried out by the Euratom joint nuclear research center, and the research conducted by contractors. Publications are grouped into: biology and medicine; chemistry; engineering and equipment; mathematics and computers; metals; ceramics, and other materials; physics; and reactor technology. Also included is a cumulative list of contracts and reports, and an author index. G.G.

N67-10476# Southampton Univ. (England).
INSTITUTE OF SOUND AND VIBRATION RESEARCH Annual Report, Year Ending Jun. 1966
[1966] 148 p refs CFSTI: HC $4.00/MF $1.00

Research activities on industrial important noise problems are reported for the following areas: (1) *Fundamental Acoustics*

and Aerodynamics–theoretical studies of vortex flow models, turbulences in jet core and pressure fluctuations in jets, sound generating mechanism in rotating machinery, and higher order propagation modes in ducts with absorbent walls; (2) *Structures and Vibration*–strain response of surface structures to jet noise, design and development of aircraft fins, vibrations of wedge-shaped sections with honeycomb cores and of a panel-cavity system, etc.; (3) *Audiology—noise-excluding earphones, diagnosis and treatment of deafness, hearing aids, noise-induced hearing loss, development of earplugs, etc.; and (4) Industrial Noise and Instrumentation*—automobile noise and vibration, diesel engine noise, silencing of road machinery, ventilation system noise suppression, etc. G.G.

N67-10574# Weizmann Inst. of Science, Rehovoth (Israel).
SCIENTIFIC ACTIVITIES Annual Report, 1965
Jacob Rycus, ed [1966] 347 p refs CFSTI: HC $7.00/1.75

Summary reports are given of scientific activities conducted at the Weizmann Institute of Science in the natural sciences. An introductory statement is included for each of the departments and research projects are briefly discussed, in such fields as applied mathematics, biochemistry, biodynamics, biological ultrastructure, biophysics, cell biology, chemical immunology, chemical physics, electronics, experimental biology, genetics, isotope research, nuclear physics, organic chemistry, photochemistry, plant genetics, polymer research, and X-ray crystallography. Details are also given on the radioisotope training center, library, and staff. L.E.W.

N67-10577# Pisa Univ. (Italy). Faculty of Engineering.
ADIMENSIONAL GRAPH FOR CALCULATING THE HYDRAULIC PROJECTION IN A CHANNEL DIVERGING FROM A HORIZONTAL HEAD [ABACO ADIMENSIONALE PER IL CALCOLO DEL RISALTO IDRAULICO IN CANALE DIVERGENTE A FONDO ORIZZONTALE
Ferdinando Paderi May 1965 10 p refs In ITALIAN Presented at the 9th Meeting on Hydraulics and Hydraulic Construct., Trieste, Italy, May 1965 *Its* Ser. 23, No. 1110 CFSTI: HC $1.00/MF $0.50

Technical data are reported, and analytic expressions derived for calculating values on hydraulic projections for application to channels diverging from a horizontal head. A schematic representation and a mathematical model for calculating these projections on a nondimensionless nomograph are presented. Transl. by R.LI.

N67-10583# RAND Corp., Santa Monica, Calif.
OPTIMAL LINEAR INVENTORY CONTROL AND FIRST ORDER EXPONENTIAL SMOOTHING
Dale M. Landi and B. Mc K. Johnson (Connecticut Univ.) Aug. 1966 13 p refs
(P-3264-1; AD-638026) CFSTI: HC $1.00/MF $0.50

A linear, fixed-interval stock replenishment policy that achieves an optimal cost balance between inventory and order-level variances is derived in this paper. The reorder rule relies on first order exponential smoothing to predict random components of the demand sequence, which are assumed to be pairwise uncorrelated with mean zero and variance that either grows or decays geometrically, or remains constant in time Author (TAB)

N67-10976# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF SOURCES OF SPACE LAW
P. I. Lukin 11 Aug. 1966 29 p refs Transl. into ENGLISH from Vopr. Mezhdunarodnogo Prava (Moscow), 1963 p 127–146 (FTD-TT-66-381; TT-66-62363; AD-639557)

Translation of Russian monograph on the basis for legality in space conquests. TAB

N67-11121# Technische Hogeschool, Delft (Netherlands).
THE FIFTH DR. ALBERT PLESMAN MEMORIAL LECTURE
Edward C. Wells (Boeing Co.) 5 Sep. 1966 33 p

Subsonic transport aircraft design is considered from the economic standpoint using a typical 4-engine turbojet cargo plane as an example. Factors represented graphically are: design payload, design range, takeoff distance, thrust loading, weight, lift-to-drag ratios during cruise and takeoff, fuel consumption, price, and utilization. It is stressed that ultimately each design is measured not only by absolute economic yardsticks but also by the relative measure of competitive economic success. To illustrate this point, passenger impressions, efficiency of the system, operational flexibility, promotional effects, and reliability are mentioned. S.P.

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Texas: Southern Methodist University, Dallas
Washington: University of Washington, Seattle

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New York: Brooklyn, Buffalo, and Rochester
North Carolina: Charlotte
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Pennsylvania: Pittsburgh
Tennessee: Memphis
Texas: Fort Worth and San Antonio
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An extensive collection of NASA and NASA-sponsored scientific and technical publications available to the public for reference purposes is maintained at the Technical Information Service, American Institute of Aeronautics and Astronautics, 750 Third Avenue, New York, New York 10017.

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

NASA SCIENTIFIC AND TECHNICAL PUBLICATIONS

TECHNICAL REPORTS: Scientific and technical information considered important, complete, and a lasting contribution to existing knowledge.

TECHNICAL NOTES: Information less broad in scope but nevertheless of importance as a contribution to existing knowledge.

TECHNICAL MEMORANDUMS: Information receiving limited distribution because of preliminary data, security classification, or other reasons.

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